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Meeting of Experts to Evaluate  
the Pilot Phase of MED POL and  
to Develop a Long-Term Monitoring  
and Research Programme for the  
Mediterranean Action Plan

Geneva, 12-16 January 1981

DRAFT  
LONG-TERM PROGRAMME  
FOR  
POLLUTION MONITORING AND RESEARCH IN THE MEDITERRANEAN  
(MED POL. - PHASE II)  
DETAILED PROGRAMME DESCRIPTION



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



WORLD HEALTH ORGANIZATION



WORLD METEOROLOGICAL ORGANIZATION



INTERNATIONAL ATOMIC ENERGY AGENCY



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

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## 1. INTRODUCTION

The Interagency Advisory Committee (IAAC) at its eighth session (Geneva, 30 June - 4 July 1980), while considering the preparation of the draft long-term programme for monitoring and research in the Mediterranean (MED POL - PHASE II), agreed\* that

"6. An additional document will be prepared by the relevant organizations outlining the technical details, workplans, timetable and budget for the various activities envisaged in the framework of the proposed MED POL - PHASE II. More specifically, the document will contain proposals for the following activities (projects):

- 6.1 Monitoring the sources of pollution including procedures to be followed for the development of reporting formats relevant to the LBS protocol. Agreed to be prepared by WHO in collaboration with ECE, UNIDO, FAO, IAEA and UNESCO. Deadline: end of September 1980. Reference: paragraph 12-14 and 39b of UNEP/WG.46/5-Prov.
- 6.2 Monitoring of internal waters including the development of sampling and analytical techniques. Agreed to be prepared jointly by FAO and WHO, with the co-operation of IAEA and IOC. Deadline: mid-September 1980. Reference: paragraphs 15-17 and 39b of UNEP/WG.46/5-Prov.
- 6.3 Monitoring of reference areas. Agreed to be prepared by IAEA with the co-operation of IOC and ICSEM. Deadline: end of September 1980. Reference: paragraphs 18-21 of UNEP/WG.46/5-Prov.
- 6.4 Monitoring of atmospheres. Agreed to be prepared by WHO with the co-operation of ECE and WHO. Deadline: end of September 1980. Reference: paragraphs 22-26, specifically 26a of UNEP/WG.46/5-Prov.

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\*UNEP/IAAC-VIII/6; paragraphs 6-8. Document referred to as UNEP/WG.46/5-Prov. was a draft which became document UNEP/WG.46/4.

- 6.5 Monitoring of rivers and saltwater marshes. Expected to be prepared by UNESCO. Deadline: end September 1980. Reference: paragraphs 22-26, specifically 26b and 26c of UNEP/WG.46/5-Prov.
- 6.6 Development of the reporting formats relevant to the Dumping and Emergency protocols. Expected to be prepared by IMCO in collaboration with UNIDO. Deadline: mid-September 1980. Reference: paragraph 39b of UNEP/WG.46/5-Prov.
- 6.7 Development of common emission standards for substances listed in annex I of LBS protocol. Agreed to be prepared by WHO with the co-operation of UNIDO, FAO, IAEA and UNEP Industry Office. Deadline: mid-September 1980. Reference: paragraph 39c of UNEP/WG.46/5-Prov.
- 6.8 Development of additional environmental quality criteria. Agreed to be prepared by UNEP. Deadline: end of July 1980. Reference: paragraph 39d of UNEP/WG.46/5-Prov.
- 6.9 Epidemiological studies. Agreed to be prepared by WHO. Deadline: end of September 1980. Reference: paragraph 39e of UNEP/WG.46/5-Prov.
- 6.10 Guidelines and criteria for the application of Article 7 (Annex III) of LBS protocol. Agreed to be prepared by WHO in collaboration with UNIDO and UNEP Industry Office. Deadline: end of September 1980. Reference: paragraph 39f of UNEP/WG.46/5-Prov.
- 6.11 Hydrodynamic modelling. Agreed to be prepared by IOC. Deadline: mid-September 1980. Reference: paragraph 39g of UNEP/WG.46/5-Prov.
- 6.12 Research on toxicity, persistence, bioaccumulation and carcinogenicity of substances listed in annexes to LBS. Agreed to be prepared by FAO in collaboration with IRPTC. Deadline: mid-September 1980. Reference: paragraph 39h of UNEP/WG.46/5-Prov.
- 6.13 Research on implications of eutrophication and concomitant plankton blooms. Agreed to be prepared by FAO in collaboration with WHO. Deadline: mid-September 1980. Reference: paragraph 39i of UNEP/WG.46/5-Prov.
- 6.14 Study on ecosystem modifications. Agreed to be

prepared by FAO. Deadline: mid-September 1980.  
Reference: paragraph 39j of UNEP/WG.46/5-Prov.

6.15 Effect of thermal discharges on ecosystems. Agreed to be prepared by FAO. Deadline: mid-September 1980. Reference: paragraph 39k of UNEP/WG.46/5-Prov.

6.16 Biogeo-cycle of specific pollutants. Agreed to be prepared by WHO (pathogens), FAO (mercury) and IAEA (lead). Deadline: mid-September 1980. Reference: paragraph 39l of UNEP/WG.46/5-Prov.

6.17 Study of pollutants' transfer. Agreed to be prepared by IAEA in co-operation with WMO (air/sea transfer) and expected to be prepared by UNESCO (river/sea transfer and sedimentation). Deadline: end of September 1980. Reference: paragraph 39m of UNEP/WG.46/5-Prov.

7. The document mentioned in paragraph 6 should contain sufficient details to enable Governments to decide about priority to be accorded to various activities (projects). The recommended format for the description of individual activities (projects) is:

- title, including reference to the relevant paragraph(s) of UNEP/WG.46/5-Prov;
- objectives: short-term objective(s) to be reached by the end of 1983 and long-term objective(s) to be reached by the end of 1990; the description of the objectives should be based on those indicated in UNEP/WG.46/5-Prov;
- background describing (i) the relevance of the proposed activity to the specific provisions of the Convention and its protocols, (ii) the link with the results of past activities of MED POL and (iii) the relationship with other activities described in the same document;
- activities envisaged to reach the objectives; this should be the major section of the description of each proposed project giving sufficient details (what is to be done and how it is going to be done), in particular for the period up to the end of 1983;
- outputs; outputs expected to be achieved by the end of 1983 should be listed separately from those to be achieved by the end of 1990;

- workplan and timetable indicating activities as well as their beginning and ending in terms of months from the start of project activities (point zero); the proposed point zero should be identified (e.g. June 1981);
  
- budgetary implications to be presented taking into account the following subdivisions: (i) direct assistance to national institutions in terms of training, experts, equipment, material, services, etc.; (ii) meetings including the cost of their organization and the cost of participation of national experts; (iii) co-ordinating costs including consultants/experts required for co-ordination as well as the cost of their travel; (iv) reporting costs; (v) miscellaneous costs including telecommunication, rental, etc; the contribution (in kind, services, cash) of the organizations proposing the projects should be indicated as part of the overall budget; budgets to be shown on a yearly (calendar years) basis with breakdown indicated above for the period up to the end of 1983; for the period 1984-1990 annual costs should be indicated.

8. The total costs of all activities which will be described in the document mentioned in paragraph 6 should not exceed US\$ 1,000,000 per year."

This document is a collation of proposals received from the various organizations, presented as submitted to UNEP.



## 2. MONITORING OF SOURCES OF POLLUTION

### 2.1 MONITORING LAND-BASED SOURCES OF POLLUTANTS DISCHARGE DIRECTLY INTO THE MEDITERRANEAN SEA (ref. paragraphs 12-14 of UNEP/WG.46/4).

Received from WHO : 6 October 1980.

#### Objectives

The long term objective of the project are defined in the Long-term programme for pollution monitoring and research in the Mediterranean (MED POL - Phase II) (UNEP/WG.46/4).

The immediate objectives of the proposed project are as follows:

- To establish and operate a programme of monitoring land-based sources of pollution which are discharged directly to the sea.
- To develop sampling and analytical techniques for the monitoring of land-based sources of pollution
- To harmonize procedures for the promotion of comparable results.
- To survey and evaluate the type and amount of the principal pollutants which are discharged directly into the coastal waters from land-based sources.
- To evaluate the results and effectiveness of applied control measures.
- To review regularly the work carried out and to adjust and re-define it as is necessary.
- To assist the Contracting Parties in preparing the information data to be submitted according to article 13 and 16 of the Protocol on Land-Based sources of pollution.

#### Background

The first comprehensive review of the state of marine pollution in the Mediterranean was undertaken in 1972. The above review along with various monitoring and research activities undertaken since that time have emphasized the importance of Land-Based Sources of Pollution.

Adopted in 1976 by the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region, the Convention for the Protection of

the Mediterranean Sea against Pollution among others provided for the control of pollution from land-based sources and for the monitoring of pollution. (see articles 8 and 10)

A more elaborate assessment of the total pollution from land-based sources in the Mediterranean Sea was undertaken during the pilot phase of MED PUL by project MED X, launched by UNEP as a complementary part of the Mediterranean Action Plan (see UNEP/WG.18/INF. 4, 14/5/79 "Pollutants from Land-Based Sources in the Mediterranean"). MED X further emphasized the importance of Land-Based Sources of Pollution and provided a comprehensive overview as well as a comparative evaluation of major point and non-point sources.

This information assisted in the preparation and development of the protocol on Land-Based Sources of Pollution which was made final and adopted in May, 1980 (Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the protection of Mediterranean Sea against pollution from Land-Based Sources, Athens, 12-17, May 1980).

Following the provisions of articles 10 of the Convention, a pilot monitoring system was established during the Pilot Project - Phase I of the Coordinated Mediterranean Pollution Monitoring and Research Programme. However, the monitoring was mainly orientated to the coastal waters, and only a limited monitoring of some land-based sources of pollution was undertaken.

The proposed herewith activities forming the basis of the present document relate to monitoring of Land-Based Sources of Pollutants which are discharged directly to the Mediterranean sea, and respond to relevant provisions of the Protocol from Land-Based Sources pollutants and more specifically to its articles 4, 5, 6 and 8.

Experience gathered during the Pilot phase of the Coordinated Mediterranean Pollution Monitoring and Research Programme will be used in the development of the proposed monitoring system of Land-Based Sources of pollution. Successful applied methodology will be continued and extended.

While the monitoring under consideration will be limited to land-based liquid sources of pollution, close coordination will be established with monitoring of other sources of pollution. Similarly, coordination will take place with the monitoring of pollutants in other environments, planned to be included in the overall monitoring system of the Mediterranean area.

#### Proposed Activities

The proposed activities are as follows:

1. Review, on a national basis, the facilities and resources available. These resources should include relevant governmental laboratories and services, university laboratories, municipal laboratories and relevant facilities in industry. The review should also include the availability of the required qualified personnel at various levels.

This work will be undertaken with the assistance of a consultant who will closely work with the participating responsible services through the national focal points.

2. Plan and organize the most economical approach for the establishment and operation of the proposed assessment and monitoring work. Basic information required would be generated by rapid pollution assessments. (This activity will be co-ordinated with the proposed inventory of sources under the planned "Project 2 Guidelines and criteria for the application of article 7 of the Protocol on Land-Based sources of Pollution").

As above, a consultant will assist in this activity.

3. Select and survey the type and amount of pollutants, on a priority basis, taking into consideration the nature of the pollutant, the level discharged, its toxicity, persistence and bioaccumulation. Design relevant high priority control activities.
4. Plan and develop sampling and analytical techniques for the monitoring of sources and level of pollutants.
5. Develop reporting formats as foreseen in the application of the Land-based Sources Protocol.

The activities described under 3, 4 and 5 will be carried out with the assistance of a consultant and in close collaboration with the participating National Institutes. The monitoring and survey aspects of the activities will be, for the most part, the responsibility of the above National Institutes.

6. Periodically assess the pollution load reaching the Mediterranean Sea according to the available and collected information and data, and to gradually improved inventory methodology.

The assessment will be reviewed by an ad hoc meeting of scientists of the Mediterranean countries.

#### 7. Meetings

Annual consultation between experts from the Mediterranean countries will be organized to review and assess the work carried out. The ad hoc meeting proposed in activity 6 above may be amalgamated in such annual consultations.

The proposed annual meetings will cover this project and also other related projects, and within the overall long-term programme.

#### 8. Training and Technical assistance.

A number of Mediterranean countries, particularly developing countries,

will require varying degrees of assistance, particularly regarding the training of personnel and exchange of knowledge and experience. This assistance will help to enable developing countries to provide the national inputs expected in this project and to assist in the land-based sources of pollution and in connection with the measures to be taken for controlling pollution.

The training component of the project will follow the lines given heretofore:

- Training of selected individuals from the Mediterranean countries.
- Inclusion of any appropriate training component within the meetings organized under item 7 above.

Some basic equipment especially expendable materials are planned to be provided with the view to promote adequacy and comparability of results.

#### Output

The expected output of this project is as follows:

- An inventory of land-based sources of pollution which will include relevant data on individual pollutant loads.
- Reference methods for the testing of various pollutants.
- Reporting formats according to the Land-based Sources Protocol.
- Evaluation of progress made in pollution control through the application of control measures.

#### Workplan and timetable

<u>Activities</u>	<u>Starting and ending (from month 0)</u>
1	2-4
2	2-4
3	7-30
4	7-30
5	7-30
Meetings	-5 4 days Meeting
	-17 " "
	-29 " "
Training	1-30 (for an actual duration of 7 1/2 m/m in total)

Tentative Budget (in US dollars)

	1981	1982	1983	1984-1990
Experts	12,000	24,000	12,000	
Equipment	60,000	30,000	15,000	
Training	5,000	9,000	9,000	
(i) Direct assistance	77,000	63,000	36,000	
(ii) Meetings*	4,000	4,000	4,000	
(iii) Co-ordination	12,000	11,000	6,000	
(iv) Reporting cost	3,000	3,000	3,000	
(v) Miscellaneous	1,500	1,500	1,500	
Total	97,500	82,500	50,500	45,000 (per year)
WHO Contribution in in services	19,000	16,000	10,000	

\*It is proposed to organize an annual meeting for stimulating, reviewing, evaluating and adjusting work undertaken by related projects. The estimated cost (4,000\$) per year represents the share of the present project to the total cost of these meetings. The additional amount provided in 1982 is intended to cover the specific needs of the present project.



### 3. MONITORING OF COASTAL WATERS

3.1 MONITORING OF COASTAL WATERS INFLUENCED BY POLLUTION FROM PRIMARY OR SECONDARY SOURCES (ref. paragraphs 8, 9, 15, 16 and 17 of UNEP/WG.46/4).  
Received from FAO as a joint FAO/WHO proposal on : 2 October 1980.

#### Introduction

Within the framework of the long-term programme for pollution monitoring and research the monitoring of the coastal waters is one of the basic activities to meet the immediate and long-term requirements of the Barcelona Convention and its protocols. The monitoring will concentrate on areas under the direct influence of pollutants from identifiable primary outfalls (discharges or coastal dumping points) or secondary (rivers) sources.

The monitoring will be carried out to:

- systematically assess, as far as possible, the levels of pollution in the coastal areas with particular reference to the substances or sources listed in Annexes I and II of the "Protocol for the protection of the Mediterranean Sea against pollution from land-based sources" (LBS);
- evaluate the effects of measures taken under the above LBS protocol to reduce pollution of the marine environment.

#### Objectives

The long-term objectives are defined in the Draft Long-Term programme for pollution monitoring and research in the Mediterranean (MED POL - PHASE II), (UNEP/WG.46/4, paragraphs 8 and 9).

Immediate objectives, during the initial three-year period, include:

- monitoring of the levels of selected pollutants in water, suspended matter, biota and sediments in selected coastal areas;
- continuation of the laboratory quality assurance programme and the intercalibration of analytical techniques to further improve comparability of data;
- provision of training, common maintenance service and smaller equipment;
- evaluation of proposed reference methods.

## Background information

The pilot phase of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL - PHASE I) included, among the seven original pilot projects, four projects that dealt mainly with monitoring the levels of selected pollutants (i.e. petroleum hydrocarbons, heavy metals, chlorinated hydrocarbons and bacteria) in biota and water. After a preparatory phase the work started essentially during 1976. One of the main objectives to be met was to assist national research centres in developing their capabilities to participate in the programme. This has to a large extent been achieved and most centres are now in a position to substantially contribute to the future activities. Common methodologies for various kinds of analyses have been developed and used. The data that was produced has generally proved useful as a contribution to a first evaluation of the state of pollution in the Mediterranean. It should, however, primarily be considered as baseline data to serve as a basis for a long-term monitoring activity.

The present document, using the experience from the pilot phase, gives an outline for monitoring levels of different pollutants and some other parameters in water, suspended matter, biota, sediments and on the shores of coastal waters of the Mediterranean. It covers the part 8, pp 8 to 9, paragraphs of the document UNEP/WG.46/4, 1 September 1980 (Draft Long-Term Programme for Pollution Monitoring and Research in the Mediterranean, MED POL - PHASE II).

## Activities envisaged

### (a) Areas selected

The selection of the monitoring areas will depend on the objectives of the components of the monitoring exercise and will include:

- monitoring of recreational waters should be carried out on beaches in highly populated areas which are affected by discharges of liquid waste and other sources of pollution;
- monitoring of shellfish culture areas should be carried out in important and representative shellfish growing zones affected by discharges of liquid waste and other sources of pollution;
- the areas to be used for monitoring selected marine organisms will depend on the availability of the species but the monitoring should ideally be carried out along transects which include both polluted and unpolluted areas;
- monitoring of sediments and suspended matter preferably along transects which include both polluted and unpolluted areas.

The areas to be monitored will be identified by the governmentally selected



national research centres in collaboration with the UN Interagency Team (IAT). The selection should be carefully co-ordinated between collaborating research centres in order to avoid overlaps and gaps.

The areas should be selected in such a way that all the above mentioned monitoring activities can be carried out within the same area. The surface of the area, although depending on the local situation, should preferably be kept as small as possible. In this way the monitoring exercise can provide an integrated picture in time and space of the pollution situation.

Considering the funds available, the number of areas will have to be limited to about 40 or 50. Potential monitoring areas and participating research centres are listed in Annex I.

(b) Participating research centres and other institutions

The monitoring will be based on the work of research centres designated by their national authorities. The selection of the MED POL participating centres will be based primarily on their willingness to participate, capability to execute the programme, previous active participation in MED POL - PHASE I project and their geographical coverage. These centres will be named "collaborating MED POL centres".

One laboratory or institution will be selected, by the corresponding government, to act as "MED POL coastal water monitoring focal point" to co-ordinate all MED POL - PHASE II activities at the national level. It will have direct contact with the Interagency Team or other bodies responsible for the coordination of the programme and will be responsible for an appropriate and timely implementation of the programme at the national level.

(c) Monitoring

The methodology developed and used during the pilot phase will be used whenever applicable. Other methods could also be used subject to a satisfactory intercalibration exercise or a quality control programme.

Additional methods will be selected, proposed and harmonized during the first three-year period of the programme as part of the research component (paragraph 39a of UNEP/WG.46/4).

The mandatory parameters selected on the basis of their relevance to the Annex I and Annex II of the Land-Based Sources Protocol are listed under paragraph 16 of UNEP/WG.46/4, p. 8. As many as possible of these parameters, depending on available funds, will be monitored in each selected area. Considering the experience from MED POL - PHASE I priority should be given when necessary to microorganisms in water and biota and contaminants in biota.

For the microorganisms the sampling frequency will be at least once a month

from May to September and three times, at equal intervals, from October to April.

Sampling of sediments for analysis of microorganisms will be carried out on the same locations and preferably with the same frequency as for the water sampling. Sampling of sediments for analysis of contaminants will also be carried out in order to obtain information on the geographical distribution of the contaminants in the whole sampling area. The frequency of sampling will depend on the local situation.

The frequency of sampling for analyses of contaminants in organisms in coastal and near-shore areas will be seasonal, i.e. four times per year, while for organisms in open waters one or two times per year may be sufficient. Analysis of microorganisms in shellfish culture areas should be carried out at least every three months. For larger areas the sampling should be considerably more frequent especially in the peak consumption period.

Sampling of suspended matter will be co-ordinated with sampling of biota and should preferably have the same frequency.

Sampling of tar balls could be co-ordinated with sampling of microorganisms in recreational waters.

The additional parameters, listed under paragraph 17 of UNEP/WG.46/4, are expected to become mandatory only within three years of MED POL - PHASE II. Accordingly, they will be initially considered as optional and will be monitored only by selected research centres.

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Already developed reference methods should be used for:

- Determination of total mercury in edible tissue of fish by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material.
- Determination of total mercury in edible tissue of mussels by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material.
- Determination of DDTs in edible tissues of shrimps and fish by gas-liquid chromatography.
- Determination of DDTs in edible tissue of mussels by gas-liquid chromatography.
- Determination of total coliforms in sea-water by the membrane filtration culture method.
- Determination of fecal coliforms in sea-water by the membrane filtration culture method.

- Determination of fecal streptococci in sea-water by the membrane filtration culture method.
- Determination of fecal coliforms in shellfish (bivalves) by the multiple-test-tube method (MPN).

For the following parameters, a detailed description of methods to be used will be prepared and discussed at meetings of participating research centres to harmonize methodology:

- Temperature, salinity, dissolved oxygen, pH, currents and nutrients in water;
- Microorganisms in sediments and biota;
- Pathogens in water and sediments;
- Metals and chlorinated hydrocarbons in water, suspended matter, sediments, plankton and in biota (except where reference methods are already developed);
- Petroleum hydrocarbons in water, sediments and biota;
- Tarballs on coast(s)
- Benzpyrene and phenols in biota;
- Radionuclides in sediments and biota.

Guidelines on observations, sampling, sample preparation and storage, analysis, evaluation of results and data reporting will be prepared using documentation already prepared during MED POL - PHASE I.

(d) Intercalibration exercise for analytical techniques and laboratory quality assurance programme

To ensure comparability of the analyses on intercalibration exercise for analytical techniques and laboratory quality assurance programme for microbiological determination will be organized as a mandatory activity of the participating research centres.

The International Laboratory of Marine Radioactivity (IAEA) in Monaco will be responsible for the organization and implementation of the intercalibration exercise for analytical techniques, meanwhile the Istituto Superiore di Sanita, Roma will implement the laboratory quality assurance programme related to microbiological determination.

Separate project outlines are prepared in this respect (see 19.2 and 19.3).

(e) Common maintenance and emergency service

To ensure a high level of analytical performance and the continuing

operation of measurement instruments a common maintenance and emergency service will be organized and implemented by the International Laboratory of Marine Radioactivity (IAEA) in Monaco. The corresponding project outline for implementation of this activity is to be found in this document.

(f) Co-ordination of the work

The national "MED POL coastal water monitoring focal points" and the collaborating research centres will be nominated by their national authorities in consultation with the Interagency Team and UNEP.

An agreement for collaboration in MED POL - PHASE II will be signed between the "MED POL coastal water monitoring focal point" (as representatives of the collaborating research centres) and the Interagency Team. Each agreement should consist of the following major parts:

- Name of "MED POL coastal water monitoring focal point" and collaborating centres, principal investigator(s), address, telephone number, etc.
  - Detailed work programme
  - Facilities, manpower, equipment, funds etc. at disposal of the research centre
  - Assistance required from the Med Trust Fund
  - Starting date and duration of the participation
- 
- Reporting routines
  - Authorized signature

The implementation of the programme will be based on the work carried out by the participating centres and co-ordinated by the Interagency Team (IAT) which will consist of FAO, WHO, IAEA. This team will be responsible for the technical co-ordination of the day-to-day work carried out by the research centres. It will have direct contact to these centres and the MED POL focal points. The reporting of the centres will be either directly to the IAT or through the MED POL coastal water monitoring focal points.

Outputs

The following are the outputs of the programme:

- Review of existing baseline data and other information on levels of pollutants in the Mediterranean (from MED POL - PHASE I reports and other available sources)
- Guidelines for the Mediterranean coastal pollution monitoring programme

- Updated bibliographic references
- MED POL focal points progress and final reports (which should include the reports prepared by the participating laboratories).
- Periodic scientific evaluation reports
- Reference methods for pollution studies in the Mediterranean Sea

#### Workplan and timetable

- Signature of agreements with participating research centres and/or co-ordinating national organizations, (April to October 1981).
- Harmonisation of methods for monitoring mandatory and additional parameters (observation, sampling, analysis, data evaluation and reporting etc.), (May to December 1982).
- Monitoring, (May 1981 to December 1990)
- Organization of the training programme, (October 1981 to December 1988).
- Purchasing and delivery of equipment, accessories, material and chemicals, (October 1981 to December 1988).
- Organization of experts visits to the participating research centre (where applicable), (October 1981 to December 1988).
- In collaboration with IAEA, International Laboratory for Marine Radioactivity in Monaco and Istituto Superiore di Sanita in Roma organize and implement intercalibration exercise and data quality assurance programme respectively, (May 1981 to December 1990).
- In collaboration with IAEA, Monaco, organize maintenance and emergency service for the basic equipment, (May 1981 to December 1990).
- Submission of yearly progress reports and data validation, (January to March of each year).
- Organization of the periodic meetings (harmonisation of methods, two years periodic evaluation, med-term etc.) of experts and/or other officer from participating and co-ordinating laboratories and institutions.

Budget (1981-1990)

	From April 1981	1982	1983	1984/1990
<b>(a) Contributions from MED Trust Fund</b>				
<b>Assistance to national institutions</b>				
- Fellowships/training	14,000	27,000	31,000	
- Experts	21,000	27,000	31,000	
- Equipment	85,000	122,000	46,000	
- Material	114,000	136,000	76,000	
- Meetings	43,000	41,000	46,000	
Co-ordination costs (FAO)	are shown as separate budget			
Co-ordination costs (WHO)	are shown as separate budget			
Reporting costs	14,000	14,000	38,000	
Miscellaneous costs	17,000	27,000	38,000	
<b>TOTAL (a)</b>	<b>308,000</b>	<b>394,000</b>	<b>306,000</b>	<b>390,000</b> (per year)
<b>(b) FAO Contribution in services</b>	<b>45,000</b>	<b>60,000</b>	<b>60,000</b>	<b>60,000</b> (per year)
<b>(c) WHO Contribution in services</b>	<b>18,000</b>	<b>21,000</b>	<b>21,000</b>	<b>18,000</b> (per year)
<b>GRAND TOTAL (a+b+c)</b>	<b>371,000</b>	<b>475,000</b>	<b>387,000</b>	<b>468,000</b> (per year)

Annex

Potential monitoring areas, participating research centres  
and "MED POL coastal water monitoring focal points"

Country/area(s)	Participating Research Centre	"MED POL focal point"
Algeria Bay of Algiers	Centre des Recherches oceano- graphiques et des Peches (CROP)	CROP
Cyprus Akrotiri Bay	Department of Fisheries	Department of Fisheries
Egypt Area off Alexandria	Institute of Oceanography and Fisheries.  Centre for Postgraduate Studies, University of Alexandria	Centre for Post- graduate Studies, University of Alexandria
France Area off Banyuls Area off Montpellier (Sets) Area off Marseille	Institute francais du Petrole  Laboratoire Arago  Institute scientifique et technique des Peches maritimes (ISTPM)	ISTPM
Greece Areas off Athens Areas off Thessaloniki	University of Thessaloniki  Ministry of Social Services  Nuclear Research Centre "Demokritos"  Institute of Oceanography and Fisheries	Ministry of Co- ordination
Israel Areas off Haifa Areas off Tel Aviv	Israel Oceanographic and Limnological Research  Hadassah Medical School, Hebrew University	Environment Protection Service, Ministry of the Interior

Italy		
Gulf of Genova	University of Genova	University of Genova
Coast of Tuscany		
Area off Rome	University of Siena	
Area off Naples		
Strait of Messina	Istituto Superiore di Sanita,	
Area off Mount	CNR, Rome	
Gargano		
Area off Ancona	University of Naples	
Area off Venice		
	University of Messina	
	Institute of Marine Biology,	
	CNR, Venice	
Lebanon		
Area off Beirut	Centre de Recherche marine	Centre de Recherche
	(CNR)	marine (CNR)
Libya		
Area off Tripoli		
Area off Benghazi		
Malta		
Area off La Valetta	University of Malta	Ministry of Health
Area off Marsaxlokk		and Environment
	Department of Health	
<hr/>		
Morocco		
Area off Al Hoceima	Instituto scientifique des	ISPM
Area off Casablanca	Peches maritime (ISPM)	
Gibraltar		
	Institut national d'Hygiene	
Monaco		
Area off Monaco	Centre scientifique de Monaco	Centre scientifique
		de Monaco
Spain		
Area off Barcelona	Instituto de Investigaciones	
Mouth of Ebro	Pesqueras, Barcelona (Cadiz)	
Area off Alicante		
Area off Malaga	Instituto Quimico de Sarria,	
Area off Cadiz	Barcelona	
Area off Palma de		
Mallorca		
	Jefatura Provincial de	
	Sanidad, Tarragona	
	Laboratorio Oceanografico de	
	Baleares, Palma de Mallorca	



Laboratorio Oceanografico del  
Mar Menor, San Pedro del  
Pinatar

Syria  
Area off Latakia

Centre for Marine Research,  
Latakia

National Oceanographic  
Committee, Supreme  
Council of Sciences

Tunisia  
Gulf of Tunis  
Gulf of Gabes  
Gulf of Hammamet

Institut national scientifique  
et technique d'Océanographie  
et de Pêche

Laboratoire Central

Institut Pasteur

Turkey  
Area of the  
Dardanelles  
Area off Izmir  
Area off Antalya  
Area off Mersin

Hydrobiological Research  
Institute, Istanbul

Middle East Technical  
University

Middle East Technical  
University

Ege University

Yugoslavia  
Istrian Coast  
Bay of Rijeka  
Middle Adriatic Coast  
Area off Dubrovnik

Marine Biological Station,  
Portoroz

"Rudjer Boskovic" Institute

Institute of Oceanography and  
Fisheries, Split

Biological Institute, Dubrovnik

#### 4. MONITORING OF REFERENCE AREAS

- 4.1 LONG-TERM MONITORING OF SELECTED POLLUTANTS IN THE REFERENCE AREAS OF THE MEDITERRANEAN SEA (ref. paragraphs 18-21 of UNEP/WG.46/4).  
Received from IAEA as a joint IAEA/IOC proposal : 3 October 1980.

##### Objectives

##### (a) Long-term objectives (until 1990)

To quantify the long-term trends in the levels of pollutants in the Mediterranean Sea as a basis for:

- Assessing the effects of pollutant inputs on the marine environment of the open Mediterranean Sea;
- Evaluating the effectiveness of the pollution prevention measures taken under the Barcelona Convention; and
- Contributing data to the Global Environment Monitoring System (GEMS).

##### (b) Short-term objectives (until 1983)

- To establish an operational international network of national institutions for taking samples and making pollutant measurements in the open Mediterranean Sea;
- To harmonize, and test in situ, the methods for sampling and pollutant analysis used by the institutions participating in the programme;
- To execute a sampling and analysis programme agreed upon by the participating institutions as specified stations in the open Mediterranean Sea;
- To assemble and disseminate the scientific data obtained during the above-mentioned operations;
- To develop a preliminary comprehensive picture of the distribution and variation of pollutant levels in the open Mediterranean Sea; and
- To prepare and develop an expanded programme for long-term monitoring to continue beyond 1983.

## Background

The monitoring efforts of MED POL - PHASE I were concentrated in the coastal areas which are under the national jurisdiction of the Mediterranean governments. The measurements of pollutant levels in the open Mediterranean conducted within the framework of MED POL - PHASE I (e.g., MED VIII) demonstrated that some pollutants are already present at measurable levels in deep Mediterranean waters. Under the circumstances, more regular and systematic data acquisition is essential to fulfil the long-term objectives indicated above. Taking into account the Joint Scientific Programme for studying the Mechanisms of Material Transport within the Mediterranean proposed by ICSEM, as well as the related national and regional programmes, the proposed Long-term Monitoring Programme should be executed in close collaboration and co-ordination with these other programmes. Although the emphasis of the ICSEM and related national programmes is placed on the scientific understanding of the mechanisms of the transport of materials, including pollutants, across the air-sea interface, water-sediment interface, etc., as well as within the water column, the major activities expected to be conducted under these programmes are similar to those under the Long-term Monitoring Programme which are to make regular and systematic measurements of pollutant levels at fixed open-Mediterranean stations, in order to determine the systematic variations of the pollutant levels in the Mediterranean marine environment as a whole. Since the cost of using oceanographic vessels is high and considerable ship-time is required for executing these programmes, it is imperative that the Long-term Monitoring Programme be well co-ordinated with other similar programmes. Therefore, it is highly desirable that these programmes become a joint programme of ICSEM and UNEP in order to measure necessary parameters altogether simultaneously on board the same vessel, in view of the limited availability of national oceanographic vessels for taking open-sea stations. (The possibility for establishing such a joint programme is being discussed at the Bureau Meeting of ICSEM at Cagliari, Italy, in October 1980).

## Execution of the programme

### (a) Co-ordination mechanism

Since the collection of samples from the open-Mediterranean stations involves the operation of oceanographic vessels belonging to various Mediterranean governments, it is proposed to establish a "Standing Committee on MED POL Cruises".

The Committee will consist of:

- Representatives of research-vessel operating agencies of the Mediterranean governments interested in taking part in the MED POL Cruises;
- Scientific experts designated by the interested governments;
- Scientific leaders of the MED POL Cruises;

- International co-ordinator of the MED POL Cruises;
- Representatives of international and intergovernmental organizations (UN agencies, ICSEM, etc.) active in the Mediterranean Sea.

The Committee will decide the following aspects of the MED POL Cruises:

- Planning of the MED POL Cruises;
- Harmonization of the methods adopted;
- Scientific review of the results obtained;
- Data handling and publication of results;
- Other arrangements necessary for the execution of the programme.

Day-to-day co-ordination of the operations should be entrusted to an international co-ordinator through a relevant international (or intergovernmental) organization.

(b) Reference stations.

Fixed sampling stations proposed for the measurements of selected pollutants in the open Mediterranean Sea can be divided into the following three categories:

(i) strait stations;

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(ii) off-estuary stations; and

(iii) gyre-centre stations.

Taking into account the stations proposed for the Joint Scientific Programme of ICSEM, which have been chosen on the basis of careful considerations of the hydrographical conditions of the Mediterranean, the following stations are proposed (see attached figure).

(i) Strait stations (6 stations)

SR-G	36°10'N	04°30'W	(Gibraltar)
SR-S	38°30'N	09°00'E	(Sardinia)
SR-T	37°50'N	11°20'E	(Tunisia)
SR-A	41°30'N	18°00'E	(Adriatic)
SR-KW	36°00'N	23°30'E	(Crete west)
SR-KE	35°00'N	27°00'E	(Crete east)

(ii) Off-estuary stations (5 stations)

ET-E	40°30'N	02°00'E	(Ebro)
ET-R1	42°00'N	04°45'N	(Rhône)
ET-R2	42°30'N	04°45'E	(Rhône)

ET-P	45°00'N	13°00'E	(Po)
ET-N	32°20'N	33°10'E	(Nile)

(iii) Gyre-centre stations (7 stations)

GY-L	43°05'N	08°00'E	(Ligurian Sea)
GY-W	40°00'N	06°30'E	(Western Basin)
GY-T	39°40'N	12°00'E	(Tyrrhenian Sea)
GY-I	37°00'N	19°00'E	(Ionian Sea)
GY-S	34°00'N	17°00'E	(off Libya)
GY-E	34°00'N	26°00'E	(off Egypt)
GY-V	34°00'N	30°00'E	(Levantine Basin)

(c) Types of sampling and parameters to be measured

(i) Marine aerosol through filtration:

- Metals;
- Chlorinated hydrocarbons;
- Low molecular weight petroleum hydrocarbons.

(ii) Vertical profile sampling of water column. Parameters to be measured:

- Nutrients (phosphate, nitrate, silicate);
- Dissolved/dispersed petroleum hydrocarbons (relatively shallow layers including testing of sampling and measurement methods);
- Metals (including testing of sampling and measurement methods until 1983);
- Chlorinated hydrocarbons (including testing of sampling and measurement methods until 1983).

(iii) Sampling of suspended matter by water filtration: vertical profile. Parameters to be measured:

- Suspended-matter load;
- Organic carbon;
- Metals;
- Chlorinated hydrocarbons;
- Petroleum hydrocarbons.

(iv) Collection of biological samples (plankton sampling in shallow layers; net towing at mid-depths; fishing for tuna, sardine and squids). Parameters to be measured:

- Metals;
- Chlorinated hydrocarbons;
- Petroleum hydrocarbons.

(v) Sediment-core sampling. Parameters to be measured:

- Metals;

- Chlorinated hydrocarbons;
- Petroleum hydrocarbons.

(d) Frequency of sampling

At least once a year, but the same station should be reoccupied as frequently as possible.

Output

Progress and the results obtained under the present programme will be reviewed by the Standing Committee at regular intervals (twice a year). Preliminary information available will be disseminated in the form of newsletters to the national institutions which are taking part in the execution of the operations. Progress reports of the programme will be submitted to the Meetings of the Contracting Parties of the Mediterranean Governments, which are expected to be held every two years.

Workplan and timetable

Establishment of the Standing Committee for MED POL Cruises and its first meeting to plan 1981 projects	April 1981
Joint shake-down cruise on board French Oceanographic vessel	May 1981
Test cruises on board Spanish Oceanographic vessel	September - October 1981
Test cruises by ship from other national participating institutions	September - December 1981
Second meeting of the Standing Committee to review activities in 1981 and plan for 1982	December 1981
Cruises by participating institutions	1982 whenever shiptime is available
Third meeting of the Standing Committee for mid-year review	May 1982
Fourth meeting of the Standing Committee to review progress and plan for 1983	December 1982
Submission of the First Progress Report to the Meeting of Contracting Parties	February 1983
Cruises by participating institutions	1983, whenever shiptime is available

Fifth meeting of the Standing Committee

May 1983

Sixth meeting of the Standing Committee

December 1984

Budget (1981-1983)

	UNEP			IAEA-IOC Contribution (1981 - 1983)
	1981	1982	1983	
<b>10. Project Personnel</b>				
11/12 Experts/Consultants	16,000	18,000	18,000	72,000
13. Administration Support	7,000	8,000	8,000	20,000
16. Travel	5,000	7,000	7,000	6,000
<b>20. Subcontract</b>				
22. Vessel operation	25,000	50,000	50,000	-
<b>30. Training</b>				
31. Fellowships	12,000	15,000	10,000	-
32. Group Training	40,000	45,000	45,000	-
<b>40. Equipment</b>				
41. Expendable	16,000	25,000	25,000	15,000
42. Non-expendable	30,000	50,000	40,000	-
<b>50. Miscellaneous</b>				
51. Operation and Maintenance of equipment	7,000	10,000	10,000	6,000
52. Reporting Costs	1,000	2,000	4,000	4,500
53. Sundry	2,000	2,000	2,000	3,000
<b>Total</b>	<b>161,000</b>	<b>232,000</b>	<b>219,000</b>	<b>126,500</b>

## 5. MONITORING OF ENVIRONMENTAL MEDIA

5.1 RIVER INPUTS TO THE MEDITERRANEAN SEA (ref. paragraphs 10d, 12d, 22-24, 26b, 26c and 39m of UNEP/WG.46/4). Received from UNESCO : 24 September 1980.

### Objectives

#### (a) Long-term objectives (1983-1990)

- To assess the actual river discharge of pollutants to the Mediterranean Sea, taking into account the modifications occurring at the river-sea interface.
- To evaluate the trends of these pollutant loads and to forecast their future evolution.
- To carry out pilot projects on estuarine and salt marshes monitoring (operational phase) (see Annex to 5.1).

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#### (a) Short-term objectives (1981-1983)

- To agree on river, estuarine and salt marshes monitoring, sampling and analytical procedures in order to make the long-term assessment of pollutant meaningful.
- To set up an interlaboratory analytical quality control system and to provide Mediterranean institutions with adequate standard reference material.
- To implement a pilot project on behaviour and monitoring of pollutant at the river-sea interface - preliminary phase including field and laboratory training (see Annex I).

### Background

This project aims to give assistance to the countries to set up their river monitoring system (Article 10.3 of the Convention) to co-ordinate the exchange of data and scientific information (Article 10.1), to ensure a common agreed methodology for pollution monitoring (Article 9.3).

The project will concern the Mediterranean Sea as limited by Article 1 of the Convention. The exchange of information through the Organization is



specifically agreed under Article 13 of the Protocol for the protection of the Mediterranean Sea against pollution from land-based sources, particularly concerning the quantity of pollutants discharged from the territories of the countries.

The proposed project is the follow-up of previous MED POL projects in which Unesco was involved: the MED IX project on "Role of Sedimentation in the Pollution of the Mediterranean" which aimed at assessing the state of pollution of river particulate material discharged to the Mediterranean, and the MED X project on pollutants from land-based sources in the Mediterranean which concerned the dissolved pollutants mass balance.

At a regional scale Unesco is also carrying out projects within the general framework of Regional Seas programme such as South China Sea and adjacent seas, Gulf of Guinea and Western Africa, Gulf of Mexico and Caribbean Sea. The experience acquired during these projects has provided a sound basis for the planning and execution of the "RIMES" project.

Moreover, at a global scale a catalogue of major rivers discharging to the Ocean has been compiled (WORRI-project) which encompasses about ten Mediterranean rivers.

Finally, RIOS-project was focussed on the processes which control estuarine and river composition.

Within the Global Environmental Monitoring System (GEMS) concerning the inland waters, Unesco has organized a workshop on "Monitoring of Particulate Matter Quality in Rivers and Lakes" held in Budapest, (November 1978), ~~produced a chapter of the GEMS-Water Operational Guide on this~~ topic, and will organize in November 1980 in Dakar a training course on water quality monitoring.

#### Activities proposed

##### (a) From 1981 to 1983

The project will start with a survey of the present status in the countries, particularly for those which met difficulties in participating in the MED-IX and MED-X projects. The consultant will visit the National Research Centres selected by UNEP and ensure that they can effectively carry out a regular monitoring of rivers. The first selection of rivers established during the MED-IX and MED-X project will be revised and amended together with the identification of the resultant needs (technician training, apparatus...). Particular attention will be paid to the laboratory carrying out the chemical analyses.

Following the survey an expert meeting of the persons in charge of river water quality monitoring in the Member States will be set up to ensure a common procedure and methodology of river monitoring including: sampling, sample conservation and pre-treatment, choice of water quality

determinants, choice of rivers, data collecting and treatment and finally to identify representative estuaries for the implementation of pilot projects.

A data collection and treatment system must be set up in agreement with the International Computer Centre in Geneva. For this the GEMS-WATER data collection system presently operating at the WHO Centre of Burlington (Canada) can be adapted to Mediterranean problems.

Unesco will co-ordinate with other participating agencies a programme of analytical quality control between the National Research Centres. This programme could be integrated within the future programmes concerning sea water, sediments and biota analyses and will start with the more common determinants monitored by every National Research Centre and end with the more difficult ones.

Following the meeting of experts from the National Research Centres, Unesco will organize technician training sessions in laboratories specialized in water analyses. These could be some National Research Centres or other laboratories from administrations, universities or UN agencies.

(b) From 1983-1990

Regular meetings of experts (each two years) to review the state of river pollutants inputs in the Mediterranean and the observed trends. This meeting will review the documents of each National Research Centre, plus data treatment output from the International Computing Centre and will provide UNEP and the countries with a critical report.

Regular Analytical Quality Control exercises will continue particularly concerning the parameters most difficult to analyse such as some heavy metals or toxic organic compounds.

The monitoring of the river-sea interface (estuarine zone) and the salt marshes will start after completion of the pilot project (see Annex I).

The river water discharges from year to year will be published as a Year book. This will serve as a basis to estimate the total water input from land to the Mediterranean, a major component of the Mediterranean water budget. This very important data is still poorly known and is likely to major changes. It is proposed to hold a special interagency workshop on this subject in which Unesco will provide the land-based sources.

### Outputs

(a) From 1981-1983

Report on present state of river monitoring (1981) after the consultants' visits and the experimenting. This report will be compared to the previous one (1976) made at the beginning of the Mediterranean Action Plan.

River water quality Yearbooks are planned each year with the help of the International Computing Centre for the data output. These Yearbooks will

be similar to national or international yearbooks (such as the Rhone Commission, or the Mekong Commission). They will serve as a basis to estimate the pollutant loads, their trends, the evolution of the monitoring activities etc.

River discharges Yearbooks will also be edited. They will be used for the computation of the pollutant loads and to estimate the evolution of the water input to the sea, threatened by damming, irrigation practises, desertification etc.

(b) From 1983 to 1990

Regular reports of the state of river pollutant loads to the Mediterranean Sea will be provided to UNEP and the Member States on the basis of expert meetings (two years intervals) and annual Yearbooks.

Identification of the major pollutant river inputs for each type of pollutant will be made regularly and communicated to UNEP and to Member States.

Estimate of the modification of river pollutants loads through the estuarine zone will be made on the basis of the experience gained in the pilot project and on the monitoring network of estuaries and salt marshes (Annex I).

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Workplan and timetable

(a) 1981 - 1983

Starting June 1981 to October 1981	Consultant visits to the countries
End of 1981	Meeting of experts from National Research Centre
March 1982	Report on the present state of monitoring of the Mediterranean Sea
March-June 1982	Organization of data collection and treatment with the International Computing Centre in Geneva
June-October 1982	Training sessions of water quality technicians
November 1982 - April 1983	First intercalibration exercise
1983	First full year of monitoring according to an agreed methodology
June 1983	Edition of 1981-1982 water quality data
March 1984	Second expert meeting to examine the 1981/1983 data

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June 1984	Edition of the first water quality yearbook covering the year 1983
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(b) 1984-1990

1984	Setting up of water quality monitoring programmes on estuarine zone and salt marshes
1986	Expert meeting from National Research Centre: progress in river water quality monitoring during 1984/1985 and improvement of their quality during this period
1988	Same for the period 1986/1987
1990	Final meeting concerning the period 1988/1989 and the total period covering 1981 to 1989

Budget

	1981		1982		1983	
	UNEP	Unesco	UNEP	Unesco	UNEP	Unesco
Direct assistance to national institutions	-	-	10,000	4,000	-	-
Equipment, material	-	-	-	-	-	-
<b>Meetings</b>						
Organizational costs	8,000	3,000	15,000	4,000	10,000	2,000
Travel	20,000	-	30,000	-	30,000	-
	28,000	3,000	45,000	4,000	40,000	2,000
Co-ordinating costs	-	15,000	-	18,000	-	2,000
Consultancy fees	8,000	-	15,000	-	15,000	-
Travel	6,000	-	4,000	-	2,000	-
Reporting costs	3,000	2,000	8,000	4,000	9,000	2,000
Miscellaneous	2,000	3,000	400	2,000	400	2,000
<b>Total</b>	<b>47,000</b>	<b>23,000</b>	<b>84,000</b>	<b>28,000</b>	<b>8,000</b>	<b>21,000</b>

For the second phase of the project, the estimated annual budget is:

(a) 1984-1989

UNESCO 20,000  
UNEP 50,000

(b) 1990

UNESCO 30,000  
UNEP 60,000

Note: The execution proper of the pilot project (Annex) is not included in the budget. This is to be financed by the country where the pilot project is located with or without financial assistance from outside.

## ANNEX

PILOT PROJECT ON WATER QUALITY MONITORING OF ESTUARINE ZONE AND ADJACENT AREAS (SALT MARSHES) (ref. paragraphs 26c and 39m of UNEP/WGG.46/4).

### Objectives

#### (a) Long-term (1983-1990)

- To assess the actual discharge of pollutant to Mediterranean Sea taking into account the biogeochemical processes occurring in the estuarine zone.
- To implement pilot projects on various representative estuaries.

#### (b) Short-term (1981-1983)

- To agree on a common methodology for monitoring water and sediment in the estuarine zone.
- To select representative Mediterranean estuaries to implement pilot projects.
- To train scientists in the field of estuarine quality control.
- To hold a workshop on specific problems relevant to Mediterranean estuaries and salt marshes.

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### Background

Described before.

### Activities

The criteria for selection of estuaries will be:

- Representativity of the estuary (including salt marshes) e.g. industrialized vs remote, river discharge.
- Adequate monitoring facilities: ship, laboratory....
- Pre-existing studies of sedimentological, hydrological characteristics...
- Quality of river monitoring (water gauging stations, long-term river quality monitoring...).

Identification of scientists and centres, with experience in the field of brackish zone monitoring, to their sampling facilities (ship and sampling apparatus); to their analytical facilities, and to their capabilities of receiving trainees.

The sites will be monitored during one year which the emphasis will be put on testing the material and the methodology (frequency of sampling, sample treatment, specific measurement etc.).

In the meantime laboratory tests will be realized to ensure the best analytical methods particularly in view of the specific estuarine conditions such as variable salinity.

At the end of the first phase (1981-1985) a report will be presented including the results of the tests, the selected methodology and guidelines for the interpretation of the collected data and implementation of the pilot projects.

The experts of the National Research Centres involved in river and ocean water monitoring in the Mediterranean will be convened to a meeting where the methodology of brackish water monitoring will be presented and discussed. The meeting should agree on a common methodology (including the choice of parameters, sampling operations, analytical work etc.) and on selected sites to be monitored in the Mediterranean.

Following the meeting training session of technicians will be organized on the pilot sites.

Monitoring of selected sites will then begin according to the agreed methodology.

Regular analytical quality control will ensure the intercomparability of water and sediments analyses. These inter-comparisons will be set up on material collected on the pilot sites or similar to them, with the help of the monitoring team.

5.2 MONITORING OF ATMOSPHERE (ref. paragraphs 22-25 of UNEP/WG.46/4).  
Received from WMO : 3 October 1980.

Objectives

(a) Short-term (1983)

- To establish an operational core network (in the frame of BAPMON) to sample and analyse air pollutants supposed to contribute to the pollution of the Mediterranean.
- To elaborate and prepare an expanded programme for long-term routine monitoring of the atmosphere (beyond 1983).

(b) Long-term (1990)

- To establish in detail the distribution and variation of pollutant levels in the atmosphere.
- To assess the deposition of pollutants into the Mediterranean Sea from the atmosphere.
- To identify long-term trends in the concentration of significant constituents in the atmosphere which may affect the Mediterranean environment.
- To predict future atmospheric pollution states and processes by using transport and deposition models to be developed and tested in the first phase of the project (in conjunction with the EMEP).

Background

The atmosphere acts as a major means of transport for pollutants ultimately deposited on water bodies and in particular on regional seas which are surrounded by potential man-made pollution sources. For example, it was estimated that between one tenth and a few percent of the total content of certain pollutants present in the Baltic Sea are annually deposited from the atmosphere. For the Mediterranean Sea as a much more enclosed body with comparable existing pollution sources, the situation should be even worse. An attempt to quantify the contribution to Mediterranean pollution by substances transported by the atmosphere and deposited by dry deposition, rain-out and wash-out is necessary to construct a picture of the relative contribution to the total and variability of anthropogenic pollution of the Mediterranean Sea.

Monitoring the atmosphere and in particular wet precipitation in open sea areas is technically difficult if not impossible to do. So far, no accurate procedure is available for sampling wet precipitation on board ships. Therefore it is necessary to develop a basis to estimate and to understand the deposition processes which can be modelled by using meteorological parameters. This has been done within the existing ECE



Co-operative Programme for the Monitoring and Evaluation of the Long- Range Transmission of Atmospheric Pollutants in Europe (EMEP) for which, with WMO's participation, Meteorological Synthesizing Centres are operated which estimate several times daily the long-range transport and deposition for a large number of localities in Europe. Part of the Mediterranean is covered in this activity in so far as this region is part of the area which is considered as possible starting points for air trajectories and long-range transport.

Continuous operating of air monitoring stations located at selected points around the Mediterranean and possibly on small islands would provide information which can be used as input to transport and deposition models. Depending on the wind field, the coastal stations would provide data on the transport from the continental source regions or the transport off the sea while stations on small islands would monitor the transport and deposition at intermediate points over the "source less" area of the sea and hence help to verify calculated deposition and model results. Both types of stations would need to monitor the concentration of the aerosol content (suspended particulate matter smaller than 15  $\mu$ m as subject to longer range transport) and the composition of wet precipitation. These stations would in principle follow the monitoring programme carried out at BAPMON and EMEP stations in Europe, but include some more parameters of particular interest to marine pollution (pesticides, organics).

Regarding theoretical (modelling) work this would be accomplished by extending the area already covered in EMEP to include the whole of the Mediterranean which is already covered to a large extent.

As far as the modelling of air flow and orographic precipitation in the northern part of the Mediterranean is concerned the results emerging from the Alpine Experiment (ALPEX) will be a valuable contribution in particular the aircraft soundings made at different levels.

#### Activities

- A feasibility study will be conducted in order to identify the best sampling sites in such a way that they will correspond to WMO Operations Manual for Sampling and Analysis Techniques for Chemical Constituents in Air and Precipitation.
- This study would include recommendations for the location of sampling sites as proposed by the EMEP Meteorological Synthesizing Centres.
- Training and consultation will be organized to disseminate the techniques for sampling of air pollutants.
- Meetings of experts will be held to discuss the problems associated with transport of pollutants from the atmosphere to the Mediterranean Sea.
- In consultation with Governments of the Region, one or two regional

laboratories will be identified for analysis of pollutants, particularly heavy metals, DDT, PCB, radio-nuclides and pathogens. This may include provision of complementary equipment.

### Outputs

#### (a) 1983 (Phase 1)

- Development of a comprehensive plan of action for future monitoring of the atmosphere.
- Implement a core network of stations for monitoring pollution of the atmosphere around the Mediterranean Sea.
- Develop proposals for a minimum long-term monitoring programme of the atmosphere in the Region.
- Tentative calculation of atmospheric deposition for certain Mediterranean sub-areas using data generated in the preliminary core-network.

#### (b) 1990 (Phase 2)

- Finalization of a long-term programme for the monitoring of the atmosphere in the Mediterranean Region.
- Preliminary quantitative assessment of the transport and deposition of atmospheric pollutants into the Mediterranean Sea.
- Report describing detailed studies conducted on monitoring of the atmosphere of the Region (including the use of mathematical models) and proposals for future work in this field.

### Workplan and timetable

<u>Activities</u>	<u>Starting and coding (from month 0)</u>
Formulation of policy guidelines	0-2
Identification of central laboratories equipped to analyse substances which require sophisticated equipment	0-6
A feasibility study for identification of the best sampling sites	2-6
Training and consultations for establishing techniques	2-12
Field monitoring programme	8-36

Search and collection of literature on atmospheric pollution of the Region	0-36
Organization and convening of meetings	10-30
Production of final report including recommendations for future air pollution monitoring in the Region	32-36

Budget.

	1981-1983		1984-1990	
	UNEP	WMO	UNEP	WMO
I. Direct assistance to national institutions in terms of training experts, equipment, etc.	180,000	50,000	245,000	100,000
II. Meetings	30,000	10,000	30,000	20,000
III. Co-ordinating costs	50,000	10,000	100,000	20,000
IV. Reporting costs	10,000	-	25,000	10,000
V. Miscellaneous	30,000	50,000	100,000	100,000
<b>Total</b>	<b>300,000</b>	<b>120,000</b>	<b>500,000</b>	<b>250,000</b>

## 6. DEVELOPMENT OF SAMPLING AND ANALYTICAL TECHNIQUES

### 6.1 LEVELS OF POLLUTANTS IN MARINE BIOTA (ref. paragraph 39a of UNEP/WG.46/4). Received from FAO : 1 October 1980..

#### Objectives

To provide proposals for additional sets of reference methods for the determination of selected pollutants to be adopted in connection with the provisions of the Convention and its related protocols.

To develop and harmonize methods for analysis of selected pollutants on a Mediterranean basis taking into account already existing standard methods.

#### Background information

The following sampling and analytical techniques, developed during the pilot phase of the project (MED POL - PHASE I), were based on the mandatory pollutants and species;

- Determination of total mercury in edible tissue of fish by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material;
- Determination of total mercury in edible tissue of mussels by flameless atomic absorption spectrophotometry after liquid pressure decomposition of the organic material;
- Determination of DDTs in edible tissue of shrimps and fish by gas liquid chromatography;
- Determination of DDTs in edible tissue of mussels by gas liquid - chromatography.

According to the basic document for long-term programme for pollution monitoring and research in the Mediterranean (MED POL - PHASE II) taking into consideration the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (LBS) several other sampling and analytical techniques for monitoring levels of pollutants in marine organisms should be developed.

### Activities envisaged

Three groups of substances for which methodologies should be developed can be identified:

- Group I : Substances and biota for which draft reference methods have already been developed.
- Group II : Substances and biota for which methods were adopted during the Phase I but for which reference methods have not yet been developed.
- Group III : Substances in Annex I and II of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources for which common methodologies have not been developed.

For the Group I substances and biota the proposed reference methods should be tested by selected research centres both representing industrial and developing countries. The methods should be evaluated under laboratory conditions and eventually compared with other methods or modifications. A short meeting of the research centres involved will technically and statistically evaluate and finalize the reference methods for adoption by the Contracting Parties.

Group II reference methods will be prepared by a consultant and based on the methodologies already used during Phase I taking into account already existing methods. In the same way as for Group I methods, the methods should then be tested by a number of selected laboratories and evaluated and finalized at a small meeting on draft reference methods for adoption by the Contracting Parties.

As Group III substances were not analysed during Phase I, no commonly accepted methodology in the Mediterranean exist. The first step would therefore have to be to organize a small meeting of analysts from the Mediterranean experienced in this field. The meeting should be organized in collaboration with the International Laboratory for Marine Radioactivity in Monaco.

The objective of the meeting will be to identify those methodologies that can eventually be developed into reference methods. These proposed methodologies will then be developed by some selected laboratories and a draft manual will be prepared during 1985. After 1985 the analyses of these substances will become a mandatory part of the monitoring. When the participating centres have sufficient capabilities with these analyses, draft reference methods can be prepared by a consultant and tested and evaluated by selected centres as for Group I and II methods. Reference methods for this group of substances are expected to be available for adoption by the Contracting Parties not later than 1986.

Should, however, the requirements of the Land-Based Sources Protocol during this period change the requirements for reference methods, new substances and methods can be introduced with subsequent amendments of the project document.

## Outputs

1981-1983

Reference methods for:

### Group I

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

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

Determination of DDTs in edible tissues of shrimps and fish by gas-liquid chromatography.

Determination of DDTs in edible tissue of mussels by gas-liquid chromatography.

### Group II

Determination of cadmium (and eventually copper and zinc) in edible tissue of fish by atomic absorption spectrophotometry after liquid pressure decomposition of the organic material.

Determination of cadmium (and eventually copper and zinc) in edible tissue of mussels by atomic absorption spectrophotometry after liquid pressure decomposition of the organic material.

Determination of PCBs in edible tissue of shrimps and fish by gas-liquid chromatography.

Determination of PCBs in edible tissue of mussels by gas-liquid chromatography.

### Group III

Draft manual for determination of radionuclides in marine organisms.

Draft manual for determination of benzopyrene in marine organisms.

Draft manual for determination of phenols in marine organisms.

Workplan and timetable

Activity	Timetable	Responsible
- Designation of national research centres to test the proposed reference methods (Group I)	April 1981	National MED Pol focal point in collaboration with FAO
- Testing period	June- September 1981	National research centres
- Meeting of the above research centres and preparation of relevant reports	October- December 1981	FAO in collaboration with research centres
- Consultant hired for the preparation of a draft for the Group II reference methods	June- December 1981	FAO
- Designation of national research centres to test Group II reference methods	January 1982	National MED Pol focal point in collaboration with FAO
- Testing period	April- September 1982	National research centres
- Meeting of the above research centres and preparation of reports	October 1982- December 1982	FAO in collaboration with research centres
- Meeting of analysts from experienced Mediterranean laboratories and IAEA to identify methodologies for Group III	September 1982	FAO
- Designation of national research centres to develop Group III techniques	January 1983	National MED Pol focal point in collaboration with FAO
- Development of techniques and preparation of a manual	April 1983- March 1984	National research centres
- Draft reference methods prepared by a consultant	September 1984	FAO
- Testing period	January- June 1985	National research centres
- Meeting of the research centres and preparation of report	October 1985- December 1985	FAO in collaboration with research centres

Budget

(a) Contribution from the MED Trust Fund

	1981	1982	1983	1984-1990
1. Direct assistance to national institutions(s)				
- Training	-	-	-	
- Experts	10,000	15,000	10,000	
- Equipment	-	-	-	
- Material	5,800	7,000	2,800	
- Services	-	-	-	
2. Meetings (Group I, II and III substances)	8,000	16,000	8,000	
3. Co-ordinating costs (FAQ)	are shown as separate budget			
4. Reporting costs	-	3,000	3,000	
5. Miscellaneous	2,000	2,000	2,000	
<b>Total</b>	<b>25,800</b>	<b>43,000</b>	<b>25,800</b>	<b>30,000 (per year)</b>

(b) Contribution from participating research centres:

- Provision of laboratory space
- Personnel (scientists and technicians)
- Operating costs of major equipment
- Other costs (secretarial assistance, minor equipment, chemicals etc.)



7. DEVELOPMENT OF REPORTING FORMATS

## 8. FORMULATION OF PROPOSALS FOR COMMON EMISSION STANDARDS

8.1 EMISSION STANDARDS FOR SUBSTANCES LISTED IN ANNEX I OF THE LAND-BASED SOURCES PROTOCOL (ref. paragraph 39c of UNEP/WG.46/4). Received from WHO : 6 October 1980.

### Objectives

To formulate the rationale for improving emission standards for substances listed in Annex I (Black list) of the Protocol on the Land Based Sources of pollution.

To formulate proposals for common emission standards for selected substances of the black list, taking into consideration needs, importance, urgency and applicability.

To formulate a long term programme for gradual development of emission standards and cover additional aspects of Article 5 of the Protocol.

### Background

Under article 8 of the Convention for the protection of the Mediterranean Sea against pollution, it is specified that the Contracting Parties shall take all appropriate measures to prevent, abate and combat pollution of the Mediterranean Sea area caused by Land-Based Sources.

Moreover, under article 15, it is foreseen that the Contracting Parties may adopt additional Protocols to the convention.

Based on these articles and on articles 4, paragraph 2 of the said Convention, the contracting parties adopted, in May 1980, in Athens, a Protocol for the Protection of the Mediterranean Sea against pollution from Land-Based Sources.

In article 5 of the above Protocol, it is stipulated, "1. The parties undertake to eliminate.... etc. (see page 2 of the Protocol, article 5).

The proposed herewith project is to formulate proposals for common emission standards for substances listed in Annex 1 of the Land-Based sources Protocol according to the above referred to Article 5 of that Protocol.

## Proposed activities

1. Undertake a detailed review of existing emission standards for selected pollutants of the "Black list" in the Mediterranean Region and in other comparable areas.

This review will include appraisal of the applicability of these standards, their results and efficiency, the difficulties encountered and their economic aspects.

2. Develop proposals for the gradual establishment of emission standards of selected substances, taking into consideration needs, urgency, conditions and economic aspects.
3. Preparation of a programme concerning the establishment of emission standards (for substances of the Black list) in general and covering also the other aspects of article 5 of the Protocol.

The proposed work under 1, 2 and 3 above will be carried out by an appropriate institute or a qualified consultant, on a contractual basis.

Moreover, it is proposed that the results of the proposed above 3 activities will be reviewed and appraised by a meeting of experts of Mediterranean countries. It is also expected that the meeting will make recommendations. This meeting may be combined with other annual meetings provided for promoting, reviewing, and evaluating the proposed parallel projects (see 5 below).

4. Follow up for the proposed programme (activity 3 above).

A consultantship is tentatively provided for to assist the initiation of the programme to be prepared by activity 3 above.

5. Meetings

Annual consultation of national experts of Mediterranean countries participating actively in the implementation of the proposed projects will be organized. The meetings will aim at stimulating the active participation of the national services in the proposed activities. They will also provide an appropriate forum for reviewing, assessing and adjusting the work carried out. The above meeting will also cover other related projects included in the long-term programme.

6. Training and Technical assistance

A number of Mediterranean countries, particularly developing countries, will require varying degrees of assistance, particularly in the aspects of personnel training and exchange of knowledge and experience through direct contact. This will enable them to provide the required national inputs in the project and to develop the necessary national service and competence for the establishment,

implementation and follow up of pollution control measures standards for use. During the first period (1981-1983) of the long-term programme, it is intended to organize a training component of the project along the following lines:

- Short training of selected individuals from Mediterranean countries in the relevant aspects of criteria and standards through appropriate seminars.
- On the job training by visiting national services and others responsible for matters concerning criteria and standards, in industrialized Mediterranean countries as well as in other countries under comparable conditions.

### Output

The expected output of this project is as follows:

Report on existing emission standards for selected pollutants (from the Black list) in the Mediterranean Region and other comparable areas, including their evaluation and economic efficiency.

Proposals for the establishment and gradual application of emission standards for selected substances (from "Black" list) based on the importance, urgency, local conditions and economic feasibility.

A long-term programme for gradual development of emission standards and for meeting all the requirements of article 5 of the Protocol.

### Workplan and timetable

<u>Activities</u>	<u>Starting and ending (from month 0)</u>
1, 2 and 3	4 - 5
4	13 - 30
Meetings	5 - 4 days meeting
"	17 - 4 days meeting
"	29 - 4 days meeting
Training	0 - 30 for a total period of 30 weeks

Tentative Budget (in US dollars)

	1981	1982	1983	1984-1990
Experts	-	6,000	12,000	
Sub-contract	10,000	10,000	-	
Equipment	-	-	-	
Training	4,500	9,000	13,500	
(i) Direct assistance	14,500	25,000	25,500	
(ii) Meetings*	4,000	9,000	4,000	
(iii) Co-ordination	3,000	5,000	4,000	
(IV) Reporting cost	2,000	2,000	2,000	
(v) Miscellaneous	1,000	1,000	1,000	
<b>Total</b>	<b>24,500</b>	<b>42,000</b>	<b>36,500</b>	<b>30,000</b> (per year)
<b>WHO Contribution in services</b>	<b>5,000</b>	<b>8,000</b>	<b>7,000</b>	

\*It is proposed to organize an annual meeting for stimulating, reviewing, evaluating and adjusting work undertaken by related projects. The estimated cost (4,000) per year represents the share of the present project to the total cost of these meetings. The additional amount provided in 1982 is intended to cover the specific needs of the present project.

PERSONNEL COMPONENT TIMETABLE

Year	1901												1902												1903												1904-1990											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30																		
Months	J A S O N D J F M A M J J A S O N D												J A S O N D J F M A M J J A S O N D												J A S O N D J F M A M J J A S O N D												J A S O N D J F M A M J J A S O N D											
Activities																																																
1																																																
2	← →												← →												← →												← →											
3																																																
4													← →												← →												← →											
5													← →												← →												← →											
Training																																																

Activities 1, 2 and 3 to be carried out on a contractual basis

← 4 days meeting

← 4 days meeting

← 4 days meeting

← 4 days meeting

9. DEVELOPMENT OF SCIENTIFIC RATIONALE FOR THE FORMULATION  
OF ENVIRONMENTAL QUALITY CRITERIA

9.1 ENVIRONMENTAL QUALITY CRITERIA (STANDARDS OF USE) FOR BATHING WATERS,  
SHELLFISH GROWING WATERS AND EDIBLE MARINE ORGANISMS, WITH PARTICULAR  
REFERENCE TO EPIDEMIOLOGICAL STUDIES. (see description under 10.1).

## 10. EPIDEMIOLOGICAL STUDIES

10.1 ENVIRONMENTAL QUALITY CRITERIA (STANDARDS OF USE) FOR BATHING WATERS, SHELLFISH-GROWING WATERS AND EDIBLE MARINE ORGANISMS, WITH PARTICULAR REFERENCE TO EPIDEMIOLOGICAL STUDIES (Ref. paragraph 39e of UNEP/WG.46/4). Received from WHO : 6 OCTOBER 1980.

### Objectives

The long-term objectives of MED POL Phase II are described in the long-term programme for Pollution monitoring and Research in the Mediterranean (MED POL - Phase II). (Reference document UNEP/WG.46/4)

The specific objectives of the proposed herewith project are the following:

- to assess the adequacy of the existing interim criteria for coastal water quality by studying them in depth and adjust as necessary;
- to develop new criteria and standards for substances listed in Annex II of the Protocol for Protection of the Mediterranean Sea against Pollution from Land-based Sources, based on regional priorities and requirements, with regard to coastal water quality;
- to ascertain the relationship between dose and response by developing appropriate epidemiological studies;
- to further promote exchange of knowledge and experience in the field of epidemiology between the countries of the region;
- to eventually develop a scheme for certification of adequate procedures, thus providing the basis for consensus and a uniform approach to the protection of human health in the Mediterranean.

### Background

The pilot phase of the Mediterranean Pollution monitoring and research programme, constituting the environmental assessment component of the UNEP-sponsored Mediterranean Action Plan was adopted by the Intergovernmental Meeting on the Protection of the Mediterranean (Barcelona, 28 January - 4 February 1975), and is scheduled to terminate on 31 March 1981.

One of the projects within this component was the Joint WHO/UNEP Co-ordinated Pilot Project on Coastal Water Quality Control in the



Mediterranean (MED POL VII). Its main objective has been the assessment of the potential health hazards connected with the coastal waters of the Mediterranean needed for the rational design and efficient implementation of national programmes for the control of coastal pollution from land-based sources in the area. The objectives also included the initiation of a scientific study on the epidemiological evidence of health effects resulting from inadequate sanitary conditions in coastal areas, and the promotion of related studies.

During the pilot phase of MED POL VII, interim environmental quality criteria for (a) recreational coastal water, (b) water of shellfish culture areas and (c) shellfish flesh, based on the available international experience, and the local conditions in the Mediterranean, were agreed upon. It was understood that such criteria would eventually have to be assessed and, if necessary, adjusted. Such assessment would require the carrying-out of short- and long-term epidemiological studies aimed at providing the necessary data base for evaluating health effects.

Article 7 of the Protocol for the Protection of the Mediterranean Sea against pollution from Land-based sources, signed by Mediterranean Coastal States in Athens in May 1980, binds the contracting parties to progressively formulate and adopt, in cooperation with the competent international organizations, common guidelines, standards and criteria, directly applicable to conditions prevailing in the Mediterranean region, required for implementation of the Protocol. Such guidelines, standards and criteria specifically include those dealing with "the quality of sea-water used for specific purposes that are necessary for the protection of human health, living resources and ecosystems".

Following the results and conclusions of the pilot phase of MED POL in March 1981, a second phase is proposed. This phase consists of a long-term pollution monitoring and research programme in terms of Articles 10 and 11 of the Convention for the Protection of the Mediterranean Sea against Pollution, as well as of relevant articles in its related Protocols. Apart from the monitoring element to maintain a continuous assessment of marine pollution levels, the programme also contains a research and study element directly relevant to the gathering of information and to the development and implementation of the measures laid down in the Convention and Protocols.

Epidemiological studies as follow-up work initiated during the pilot Phase I in that domain are also included in Phase II.

The present proposed project forms part of the research and study element of Phase II of MED POL (UNEP/WG.4, item 39, paragraph e), it is also complementary to the other project proposed also in Phase II and concerning the studies on Guidelines and Criteria for the application of Article 7 of the Land-based Pollution Protocol, (project 1 here included), in that it covers the aspect of coastal water quality criteria defined therein.

## Proposed activities

1. Assessment of the adequacy of existing interim criteria for coastal water quality.

The proposed activity is aimed at providing the data required for the assessment of existing interim quality criteria in coastal area in relation to human health.

The following work will be undertaken during the first period (1981-1983) of the long-term programme:

- 1.1 A critical review of relevant literature dealing with relationships between quality criteria established in relation to bathing water culture water for shellfish, and shellfish flesh, and human health; this should include assessment of some important determinants influencing these relations such as (waste water treatment, disinfection, epidemiological situation).
- 1.2 A collaborative regional investigation on the relationships between present quality criteria and the presence of selected pathogens of importance in the region. This will include simultaneous assessment of indicators representing present quality criteria and selected pathogens including Salmonella, Shigella, Yersinia. For these indicators and pathogens, as well as for viruses, their presence will be investigated in water, shellfish and sediments. Relevant monitoring activities would be coordinated with those related to monitoring of coastal waters proposed in other parallel activities.

The first item will be undertaken with the assistance of an expert consultant. The second one will also be carried out with the assistance of an expert who will organize the programme, in collaboration with participating national institutions interested in this specific subject, and eventually prepare the relevant evaluation.

During the second period (1984-1990), the following work will be carried out:

- 1.3 Extended investigations based on experience gained in 1.2 above.
2. Development of expected requirements of new criteria and standards for additional substances listed in the Land-Based Pollution Protocol, with regard to coastal water quality.

This activity is necessarily an extension of the first activity and will be particularly directed at relevant pathogenic micro-organisms. The work is envisaged for performance during the second period (1984-1990) of the long-term programme and will consist of the following:

- 2.1(a) Extended investigations based on simultaneous assessment of selected indicators from experience gained during the first period, supplemented eventually by coliphages, and of selected pathogens such as Campylobacter, Pseudomonas aeruginosa, Staphylococci, Vibrio, selected intestinal viruses and certain protozoa.
- 2.2(b) Comparison of selected pathogens and known indicators (coliforms, faecal coli, faecal streptococci, Clostridium perfringens, coliphages, coprostanol) may be undertaken. Selection of new and better indicators marking faecal pollution may result.
- 2.2 Following results from epidemiological studies indicating that some organisms such as protozoa play a role in health risks, supplements to existing methodological guidelines with regard to the above-mentioned organisms may be prepared. Such guidelines would involve techniques of monitoring of sea water, sediments, shellfish and coastal sand.
- 2.3 Collaborative regional investigations as to the presence of antibiotic resistant bacteria. Such examinations would involve organisms such as enterotoxigenic E. coli and Salmonella. Results must be expressed as a percentage of resistant faecal coli with reference to a sampling point.

The first item will be undertaken with the assistance of an expert for preparation and organization of the programme in collaboration with participating national institutions interested in this specific subject, and also for preparation of final evaluation. The second item will be undertaken with the assistance of three short-term expert consultants with respective specializations in bacteriology, parasitology and virology. The third item will be undertaken with the assistance of an expert consultant for preparation and coordination of the programme, and eventually for the preparation of the evaluation report.

### 3. Development of appropriate epidemiological studies

This activity is intended to provide the necessary data on health effects connected with the water quality as measured by microbiological, chemical or physical indicators of its pollution in different areas of the Mediterranean, at different times of the year, and including both non-resident and resident groups.

The activity will consist in the matching of available environmental data with clinical symptoms of disease in selected random samples of the population, the latter to be determined by direct personal interview and a mailed questionnaire to enable investigation of both short- and medium-term symptomatology. During the first period (1981-1983) of the long-term programme, the activity will proceed as

follows:

- 3.1 convening of a meeting of national epidemiologists to formulate the methodology of the proposed studies and decide on sampling areas, taking into consideration the monitored selected coastal areas included in MED POL phase II (UNEP/WG.46/4).
- 3.2 initiation of the epidemiological studies themselves (during the first half of 1982), with continuous evaluation by national epidemiologists from participating countries and transmission of results to responsible national authorities.

An interim evaluation should be available by the end of this first period.

The first item will be undertaken with the assistance of an expert consultant to prepare the necessary background and working documentation for the meeting. Similarly, a consultant would also be engaged to assist in the organization and coordination of epidemiological studies themselves and in the preparation of the interim evaluation.

The project will be further developed and expanded during the second period (1984-1990) of the long-term programme.

#### 4. Meetings

Annual consultations between epidemiologists (and scientists in other relevant disciplines) in Mediterranean countries, responsible for carrying out the national components of the project will take place. The first consultation meeting (1981) will aim at providing the necessary briefing to ensure full awareness of the implications of the project, at defining the degree of participation by the various Mediterranean countries and at ensuring harmonization of inputs. However for the specific tasks provided in 3.1 above, the meeting for 1981 will be extended for three additional days.

A mid-term meeting (1982) will review progress and agree on any necessary remedial measures and/or adjustments. The third meeting (1983) will preview the results achieved during the first period of the long-term programme and plan for the future.

Advantage will be taken of all three meetings to (a) include a suitable training component; and (b) to cover relevant ground common to other similar projects within the long-term programme.

#### 5. Training and Technical Assistance

Varying degrees of technical assistance appear to be necessary in a number of Mediterranean countries, particularly as regards training of personnel and exchange of knowledge and experience through mutual

contact, in order to enable the provision of the national inputs to the project and the implementation of the Convention and the relevant Protocols. Furthermore, it will also be necessary to develop training in standardized methodologies in order to promote comparability of results.

During the first period (1981-1983) of the long-term programme, it is intended to organize a training component of the project along the following lines:

- 5.1 Training of selected individuals from Mediterranean countries in the relevant aspects of national participation in the project and eventual implementation of measures agreed upon.
- 5.2 Inclusion of any appropriate training component within the meetings organized under item 4 above.

A limited amount of equipment especially expendable materials aiming at promoting accuracy and comparability of results is also intended to be provided to the participating national laboratories nominated by the National Focal Points.

#### Workplan and timetable

The implementation of this workplan is subject to the availability of funds for each activity proposed.

Activities	Starting and ending (from month 0)
1.1	3-4
1.2	3-22
3.1	4-5
3.2	7-25
4, Meetings	-5 7 days meeting -17 4 days meeting -29 4 days meeting
Training	6-24 (for a period of nine m/m in total)

Tentative Budget (in US dollars)

	1981	1982	1983	1984-1990
Experts	18,000	24,000	18,000	
Training		18,000	9,000	
(i) Direct assistance	63,000	72,000	42,000	
(ii) Meetings*	9,000	4,000	4,000	
(iii) Co-ordination	11,000	11,000	6,000	
(iv) Reporting cost	3,000	3,000	3,000	
(v) Miscellaneous	1,500	1,500	1,500	
				55,000 (per year)
<b>Total</b>	<b>87,500</b>	<b>91,500</b>	<b>56,500</b>	<b>235,500</b> (per year)
WHO Contribution in in services	17,000	18,000	11,000	

Note: Activity 2 will be initiated after 1983.

\*It is proposed to organize an annual meeting for stimulating, reviewing, evaluating and adjusting work undertaken by related projects. The estimated cost (\$4,000) per year represents the share of the present project to the total cost of these meetings. In 1981 an additional amount (\$5,000) has been included. It represents the specific needs of the present project in order to carry out the tasks provided in times 3.1 and 4.



11. DEVELOPMENT OF GUIDELINES FOR APPLICATION OF ARTICLE 7  
OF LAND-BASED SOURCES PROTOCOL

11.1 GUIDELINES AND CRITERIA FOR THE APPLICATION OF ARTICLE 7 OF THE  
PROTOCOL ON LAND-BASED SOURCES OF POLLUTION (ref. paragraph 39f of  
UNEP/WG.46/4). Received from WHO : 6 OCTOBER 1980.

Objectives

The long-term objectives of MED POL - PHASE II are described under the  
Chapter "Objectives" of the document UNEP/WG. 46/4.

The specific objectives of the proposed activity, related to the  
implementation of measures provided in the Protocol concerning pollution  
from land-based sources, are to:

- develop a format for data collection of major types of pollution sources;
- make a comprehensive inventory of major sources of wastes discharge  
directly into the sea;
- assess the nature and quantity of selected pollutants entering the sea  
from important land-based sources;
- review present waste treatment and disposal practices;
- review legal instruments and regulations for waste disposal;
- identify government services dealing with pollution sources control,  
through nominated National Focal Points;
- develop guidelines and 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 which 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 selected substances, listed in Annexes I and II of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources, discharged, their concentration in effluents and methods discharging them;

- assist in training personnel, necessary for the application of the guidelines.

### Background

Under the terms of the Convention for the Protection of the Mediterranean Sea against Pollution, adopted in Barcelona in 1976, the Mediterranean Coastal States signed the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources in Athens in May 1980.

Article 7 of the above-mentioned Protocol (annexed to this project document) binds the Contracting Parties to progressively formulate and adopt, in cooperation with the competent international organizations, common guidelines, standards and criteria dealing with the various measures required for implementation of the Protocol. The same article also specifies that such guidelines, standards and criteria should be directly applicable to conditions prevailing in the Mediterranean region.

During the pilot phase of MED POL (1975-1980), one specific project (MED POL X) provided a preliminary survey of pollutants from land-based sources in the Mediterranean. Other projects, by providing data on existing levels of pollutants in coastal waters (MED POL VII), and in the tissues of selected marine organisms (MED POL II and II), as well as on pollution of the Mediterranean Sea through rivers (MED POL IX) have given an indication of the degree of existing pollution from land-based sources.

The results of the pilot phase of MED POL have provided an approximate initial picture of the state of pollution of the Mediterranean Sea. The formulation of guidelines, standards and criteria for the control of land-based pollution, however, requires complementary information on current conditions and activities within the region, as well as on the various constraints limiting the necessary control measures.

Phase II of MED POL consists essentially in a long-term pollution monitoring and research programme in terms of Articles 10 and 11 of the 1976 Barcelona Convention, as well as of relevant Articles in the various protocols, including Articles 5, 6, 7, 8 and 9 of the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources.

Apart from the monitoring element to maintain a continuous assessment of

marine pollution levels, the long-term programme also contains a research and study element directly relevant to the gathering of information and to the development and implementation of the measures laid down in the Convention and Protocols.

The present proposed activity forms part of the research and study element of Phase II of MED PUL, and is closely related with the part of the long-term programme dealing with monitoring of land-based sources of pollution (chapter A) as well as the research and study topics under paragraph 39e of UNEP/WG.46/4.

#### Proposed activities

1. Length, depth and position of pipelines for coastal outfalls, taking into account, in particular, the methods used for pre-treatment of effluents

The following activities will be undertaken during the first period (1981-1983) of the long-term programme:

- 1.1. A critical review of existing literature on the role of pipelines in the sanitation system, including experimental evidence on benefits and limitations, and evaluation of applicability or otherwise to the Mediterranean area.
- 1.2. Compilation of reliable and detailed information on existing legislative measures regarding the discharge of wastes through submarine outfalls in Mediterranean countries.
- 1.3. Recording the main types of sanitation systems existing in the Mediterranean area, together with their reported efficiency, with particular reference to submarine outfalls.
- 1.4. Conduction with the co-operation of local authorities of in situ investigations on selected submarine outfalls their technical efficiency and cost-effectiveness.
- 1.5. Development of a code of practice related to the use of submarine outfalls, preceded by various forms of treatment, for sewage discharge, aimed at facilitating evaluation of the optimum design of outfalls, and diffuser systems.

It is intended to undertake the first three items with the assistance of a consultant expert on the sanitation of marine waters with experience in the design of treatment plants and submarine outfalls and close participation of national competent services. The last two items will be carried out with the assistance of a consultant expert in research and design of coastal water sanitation systems, inclusive of treatment and dispersion work, in close participation with national Mediterranean experts. Draft reports will be circulated to individual

experts, mainly from Mediterranean countries, for comments and advice, wherever appropriate.

The second period (1984-1990) will be devoted to extension and updating of all items and to more detailed investigations on item 1.4, which will be extended to cover sanitation systems relying mainly on treatment accompanied by either discharge or reuse.

2. Special requirements for effluents necessitating separate treatment

Compliance with the terms of the Protocol will involve the ad hoc treatment of certain effluents prior to discharge. This will apply particularly to Annex I substances and also, depending on amount and other considerations, to Annex II substances.

The following work will be undertaken during the first period (1981-1983) of the long-term programme:

2.1 Identification and categorization of effluents requiring special treatment.

2.2 Listing of the special treatment and/or other requirements normally associated with or advisable for such effluents.

2.3 Compilation of a Mediterranean inventory of such effluents, including type, category, amount, locality and existing treatment, together with, wherever possible, those local characteristics influencing the effects of such effluents and the feasibility of special treatment.

2.4 Formulation of draft common guidelines, standards and criteria, based on the analysis and evaluation of 2.1, 2.2 and 2.3 above.

It is intended to carry out the first three items with appropriate consultant assistance and close participation of national services. In addition, the Mediterranean inventory (2.3) will be compiled through the formulation and distribution of an adequate questionnaire, the format of which will be submitted in draft form to Contracting Parties for their comments, adjustments and endorsement. The fourth item will be developed with the assistance of a consultant, Mediterranean scientists and a small expert working group.

During the period 1984-1990 of the long-term programme, it is intended to consolidate, complement, extend and update the guidelines in light of the results, emerging priority needs and experience gained during the first period.

3. The quality of sea water used for specific purposes that is necessary for the protection of human health, living resources and ecosystems.

Studies on this topic will be carried out as part of a separate

project "Epidemiological studies relating to the confirmation and eventual revision of the proposed environmental quality criteria (standards of use) for bathing waters, shellfish growing waters and edible marine organisms". (proposed project relevant to item 39, paragraph e of the document UNEP/WG.46/4)

These studies will include the following:

3.1 Definition of each specific use of sea water and each convenient parameter involved, including work on "minimally acceptable" to "safe" concentrations of substances in (a) receiving waters and (b) marine organisms. This will apply particularly to Annex I substances, on which regional agreement is required as a matter of priority.

3.2 Evaluation of possible standards on sea water and marine organisms, including the formulation of a range of values pertaining to short-term and long-term objectives. The different background values typical of various Mediterranean areas will be taken into account in the formulation of such standards as well as feasibility, cost and reliability of the various solutions required for compliance.

4. The control and progressive replacement of products, installations and industrial and other processes causing significant pollution of the marine environment

The first period of the long-term programme will be mainly devoted to identification of problem areas and, wherever possible, their categorization from the solution viewpoint into short, medium and long term.

The following will be undertaken during the first period (1981-1983):

4.1 Identification and categorization of those products, installations and industrial and other processes causing significant pollution of the marine environment.

4.2 Compilation and evaluation of already existing international experience of available control measures, including the use of alternative products and processes, and adjustments to installations, taking into account the conditions prevailing in the Mediterranean.

4.3 A comprehensive survey of the situation currently existing in the Mediterranean with regard to 4.1 above.

4.4 The formulation of draft guidelines, including possible timing for implementation, based on 4.1, 4.2 and 4.3 above.

It is intended to perform the first two items with the assistance of an appropriate consultant. The survey of the Mediterranean situation

(4.3) will be carried out through the preparation and distribution of an adequate questionnaire, the format of which will be submitted in draft form to the Contracting Parties for their comments, suggestions and endorsement. The fourth item will be developed with the assistance of a consultant and a small working group of Mediterranean scientists.

The second period, 1984-1990, will be utilized to consolidate, extend and update the results obtained during the first period (1981-1983). It will be a natural follow-up aimed at regularizing the position to the fullest extent possible by 1990.

In case of the unavailability of funds, the above proposed activity (item 4) will be postponed accordingly.

5. Specific requirements concerning the quantities of selected substances listed in Annexes I and II discharged, their concentration in effluents and methods of discharging them

The following activities will be undertaken during the first period (1981-1983):

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5.1 Investigation of the rationale for imposing emission standards, with particular reference to the need for limitations even when "safe" concentrations in sea water and marine organisms have already been attained. This activity will be coordinated with the proposed activity dealing with emission standards. ("Emission standards for substances listed in Annex I of the land-based sources Protocol")

5.2 With reference to 5.1 above, preparation of an updated list of the many categories of land-based sources of pollution in the Mediterranean clearly differentiated (e.g. domestic sewage, urban sewage, various industrial waste waters, storm drainage, etc.). For each category, the most suitable administrative procedure for assessing discharged quantities should be specified. To this end, for example, quantities per unit of industrial products, emission rate per inhabitant served, concentrations in effluents, load of pollution over time or combination of these measures should be established.

5.3 On the basis of 5.1 and 5.2 above, evaluate the benefits and limits of (a) source control; (b) separate or centralized treatment and dispersion by pipeline, taking into account both proposed sea water criteria and/or standards (prepared under separate aspects of the programme) and the influence of local conditions, including engineering feasibility, cost, economic impact, etc.

5.4 Review of relevant existing literature.

The work above will be carried out with appropriate consultant assistance in close collaboration with responsible national services.

During the second period (1984-1990), the work outlined in 5.2 and 5.3 above will be developed further and carried to conclusion.

## 6. Meetings

In addition to the provided ad hoc small scientific meetings, annual consultation between national experts of Mediterranean countries participating actively in the implementation of the proposed project will be organized. The meetings will aim at stimulating the active participation of the national services, in the proposed activities.

Moreover, these meetings will provide an appropriate forum for reviewing the program and for formulating required adjustments and corrections or for formulating new approaches.

The above meetings will cover not only this project but also related ones included in the long-term programme.

## 7. Training and Technical Assistance

A number of Mediterranean countries, particularly developing ones, will require varying degrees of assistance, particularly as regards training of personnel and exchange of knowledge and experience through mutual contact, in order to be able to provide the national inputs to the project and assist in the development of national services in connection with the formulation and application of guidelines.

During the first period (1981-1983) of the long-term programme, it is intended to organize a training component of the project along the following lines:

7.1 Training of selected individuals from Mediterranean countries in the relevant aspects of national participation in the project and eventual implementation of measures agreed upon.

7.2 Inclusion of any appropriate training component within the meetings organized under item 6 above.

The training component of the project during the second period (1984-1990) will be a natural follow-up of that undertaken during the first period in the light of experience and requirements.

## Outputs

(1981-1983) - The following outputs are expected depending on the implementation of the proposed relevant activities:

- 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.
- Categories of effluents requiring separate treatment, and requirements normally associated with them.
- Mediterranean inventory of effluents requiring separate treatment, taking into consideration, as much as possible, local characteristics and feasibility.
- Draft guidelines for discharge of effluents requiring separate treatment.
- Priority list of products, installations and industrial and other processes causing significant pollution of the marine environment, and availability of control measures and progressive replacement methodology.
- Mediterranean inventory of products, installations and industrial and other processes listed in the preceding output.
- Draft guidelines and timetable for control and progressive replacement.
- Evaluation (advantages and disadvantages) of a priori limitations of quantities of pollutants discharged.
- Appropriate administrative methods for assessing the discharged quantities of pollutants.
- Critical review of existing criteria for discharge limitations and practical consequences.
- Development of questionnaire for completion of Mediterranean inventories.
- Development of trained personnel.

(1984-1990)

- Extension and/or updating of outputs during 1981-1983.
- Standards for Mediterranean waters and marine organisms, including feasibility and economic impact.
- Guidelines for economical and reliable methods of discharge limitations.

Workplan and timetable

<u>Activities</u>	<u>Starting and ending (from month 0)</u>
1.1	1-2
1.2	2-4
1.3	2-5
1.4	4-24
1.5	23-25
2.1	2-3
2.2	2-3
2.3	3-18
2.4	19-21
Study group meeting	20-
4.1	1-3
4.2	1-3
4.3	3-15
4.4	15-17
Study group meeting	16-
5.1	4-5
5.2	10-22
5.3	22-24
Annual meetings	3 x 4 days meeting <del>5(1981)-17(1982)-29(1983)</del>
Training	0-30 (for a period of fifteen m/m in total)



Tentative Budget (in US dollars)

	1981	1982	1983	1984-1990
Experts	60,000	72,000	56,000	
Equipment				
Training	9,000	18,000	18,000	
(i) Direct assistance	69,000	90,000	72,000	
(ii) Meetings*	4,000	14,000	14,000	
(iii) Co-ordination	11,000	15,000	14,000	
(iv) Reporting cost	3,000	3,000	3,000	
(v) Miscellaneous	2,000	2,000	2,000	
<b>Total</b>	<b>89,000</b>	<b>124,000</b>	<b>105,000</b>	<b>60,000</b> (per year)
<b>WHO Contribution in services</b>	<b>18,000</b>	<b>25,000</b>	<b>20,000</b>	

Note: Activity 3 will be considered under project 2 "Environmental quality criteria (standards of use) for bathing waters, shell fish growing waters and edible marine organisms, with particular reference to epidemiological studies.

\* The estimated cost (\$4,000) per year represents the share of the present project to the total cost of the proposed annual meetings. These meetings are intended to cover a number of related projects (here the calculations are based on 6 projects) and to stimulate, review and evaluate the work undertaken.



## 12. HYDRODYNAMIC MODELS

12.1 DEVELOPMENT OF HYDRODYNAMIC MODELS RELEVANT TO POLLUTANT TRANSPORT AND POLLUTION CONTINGENCY PLANNING IN THE MEDITERRANEAN (ref. paragraph 39g of UNEP/WG.46/4). Received from IOC : 8 September 1980.

### Introduction

Data collection by itself does not provide new knowledge. It is only when such data are constructed or integrated into a conceptual model that the data contain any intrinsic meaning and can contribute to either the understanding or the management of society's use of the environment. Several million oceanographic data have been obtained in the Mediterranean Sea. To reduce them to comprehensibility, oceanographers have traditionally drawn maps showing the distribution of various properties of the sea water. Such maps are instantaneous pictures, but, because of restrictions in the area of a given study or of the lapse of time required to make observations, such pictures are themselves assemblages of information that are not necessarily internally compatible. Only by inference can the dynamics of the sea, over comparatively restricted spaces and times, be envisaged from such pictures, even by experts. The dynamics of the Mediterranean Sea as a whole have generally, to a first, rough approximation, been described, but this is not sufficient for environmental management.

The greatly increased capacity of oceanographers to process large volumes of data by computers now makes it possible to reduce such data even further and to define better, on the basis of available theory, the variables governing the dynamics of the sea, so that from general equations specific forecasts, with fairly well defined limits of confidence, should now be possible by making an appropriate choice of variables to be measured. Since different parts of the Mediterranean Sea behave differently, the time and space scales to which the equations refer have to be chosen to fit particular requirements.

These descriptions of the sea that allow the prediction of some future state from some given earlier state are generally called hydrodynamic models. Various types (descriptive, mathematical, numerical, etc.) of model allow various qualities of prediction and make various kinds of demands of the data, but all have this predictive property.

The movement of the water is the predominant factor in the transport of pollutants, such as an oil slick on the sea surface, or heavy metals

dissolved in the sea water, or pesticides absorbed to particles suspended in, or slowly settling out of, sea water. Meteorological data play an important role in the design of models of sea-surface transport, especially in a virtually enclosed sea like the Mediterranean.

Since areas of relatively high risk from marine pollutants can usually be identified from general knowledge of the region, hydrodynamic models can be designed for use in specific areas and for specific pollutants, once the nature of the association (e.g., dissolved, suspended) between the pollutant and the sea water is known.

Hydrodynamic models are developed from current knowledge of the sea to which they apply, using available data. As that knowledge increases, the models can generally be improved and tested by new data; they can also determine better kinds of data by which they can be tested, which leads again to increased knowledge.

### Background

Hitherto, only very general or very localized models of sea water movements in the Mediterranean Sea have been developed. Unesco organized two workshops in 1974 and 1976 on the modelling of Mediterranean ecosystems (Unesco Reports in Marine Sciences, Nos. 1 and 2), and is planning another on quantitative analysis and simulation of Mediterranean coastal ecosystems, but these do not deal in any detail with water movements.

Sophisticated, though general, models have been developed elsewhere and have some degree of applicability to the Mediterranean Sea, but the Mediterranean Sea in many respects is a unique body of water. For this reason, even relatively precise models developed for other sea areas, such as the Baltic Sea, have only a limited applicability to the Mediterranean Sea. Thus a special effort is required to develop suitable models for the Mediterranean.

In certain localities (e.g., Rijeka Bay, Yugoslavia and the Catalan Sea), precise models have been, or are being, developed, and have a high validity for their respective localities.

Some general pollutant-transport models, in the form of computer programmes, such as the Shell Oil Company SLIKTRAK and the IOC DRFTEX (developed under contract to IOC, through MED-VI, by the Instituto de Investigaciones Pesqueras, Barcelona) programmes, have a genuine general applicability in the Mediterranean, but their refinement to suit the conditions in the Mediterranean Sea or any particular part of it remains desirable.

### Objectives

To develop, using existing data, hydrodynamic models of:

- (a) the horizontal circulation in the surface coastal waters of the

Mediterranean in areas of dense oil or liquid natural gas tanker traffic or oil tanker ballast/bilge water discharge, on a time scale of 15 days, with a view to the assessment of risk of coastal oil pollution;

- (b) the water exchange between the Mediterranean Sea and the Atlantic Ocean through the Straits of Gibraltar, with a view to the assessment of the transport of selected pollutants into, and out of, the Mediterranean by sea water;
- (c) the water exchange between the western and eastern basins of the Mediterranean Sea. This should be coupled with model (b) to give a realistic purging time of a given dissolved or suspended pollutant from one basin to the other, taking into account the input from within each basin and from the Atlantic Ocean itself;
- (d) the downward transfer of water, especially in the northern Ligurian, northern Adriatic and northern Aegean Seas, under the influence of the so-called bora winds, on a time scale of one month.

#### Project description

Four consultants will be hired to prepare the preceding four kinds of hydrodynamic model. For this purpose they will review existing models relevant to the Mediterranean, and relevant studies, past and present. They will meet once for this purpose, after a period of pre-sessional work. If necessary, some additional travel for purposes of consultation with other scientists will be undertaken.

In principle, each consultant will develop one of the four proposed models, but, if desirable, they may collaborate in appropriate combinations.

They will meet a second time to complete and agree their models, and to prepare their final report. Again some additional travel for purposes of consultation may be undertaken if necessary.

The IOC will then arrange for an independent assessment of the models, after which it will, if the independent assessment is favourable, publish the models for the use of the marine scientific community in the Mediterranean and elsewhere.

#### Workplan and timetable

<u>Activity</u>	<u>Period</u>
Hiring of four experts	July 1981
Review of existing models relevant to the Mediterranean	August - October 1981

- Development of models (including assessment of existing data relevant to this development) June 1982
- Presentation of models in final consultant report, with proposals for testing these models with field data and related information and, if necessary, by computer July - October 1982
- Independent scientific review of models proposed (arranged by IOC) November - December 1982
- Publication of models, distribution to institutions in Mediterranean region and elsewhere January - February 1983

Budget

	1981	1982	1983	Total
Experts	10,000	20,000	-	30,000
Admin. support	2,000	4,000	1,000	7,000
Travel	5,000	5,000	-	10,000
Report	-	-	2,000	2,000
Miscellaneous	3,000	5,000	-	8,000
Total	20,000	34,000	3,000	57,000

Follow-up

The proposed and scientifically approved models should be tested using new and previous field data, including data obtained specifically for such testing, which should be done in late 1983 and subsequently, after improvement of the models, from time to time (say every three years) during the balance of the long-term monitoring and research programme.

### 13. RESEARCH ON TOXICITY, PERSISTENCE, BIOACCUMULATION AND CARCINOGENICITY OF SELECTED SUBSTANCES

13.1 RESEARCH ON THE EFFECTS OF OIL DISPERSANTS ON MARINE ORGANISMS (ref. paragraph 39h of UNEP/WG.46/4). Received from FAO : 1 October 1980.

#### Objectives

The basic aim of this project is to determine the toxicity of oil dispersants to marine organisms under Mediterranean conditions in order to ensure that chemical control of oil pollution at sea and on beaches causes the minimum possible harm to marine life in the region.

#### (a) Short-term objectives (1981-1983)

- To determine the comparative acute toxicity of the principal oil dispersants on the international market under the ecological conditions prevalent in the Mediterranean Sea, both on their own, and in the form of oil/dispersant mixtures.
- To determine, at a preliminary level, sub-lethal effects of the principal oil dispersants on a selection of marine organisms to provide the foundations of a long-term programme, taking into consideration the possible combined effects of oil dispersants and other pollutants in coastal waters.

#### (b) Long-term objectives (1984-1990)

- To determine as accurately as possible, and on a continuing basis, the lethal and sub-lethal effects of oil dispersants under all possible aspects of their conditions of use, including acute and chronic toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity, in order to provide a continuous flow of information on the hazards to marine life arising out of the use of chemical dispersants to control oil pollution.

#### Background information

Oil pollution at sea, especially in coastal waters, is one of the main problems in the Mediterranean Region. Though a variety of methods are used for control, the main one is the application of chemical dispersants, which is performed on a wide scale. The obvious limitations of other methods of recovery and control indicate that chemical dispersants will remain the principal tool for oil pollution control.

Although the modern generation of dispersants are considerably less toxic to marine life than their predecessors, a considerable amount of work has to be performed to determine even their approximate, let alone their exact 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 the more northern seas. Sub-lethal effects are still relatively unknown. Similarly, very little work has been performed on the effects of dispersants, and of oil/dispersants mixtures, in the presence of other pollutants. Experimental evidence obtained so far with dispersant/heavy metals combinations show that effects vary with the particular combination from synergistic to antagonistic. The persistence of dispersants and their possible bioaccumulation still remains to be properly studied, as well as possible carcinogenic and mutagenic effects.

This project attempts to fill this essential gap in the knowledge of the hazards associated with oil dispersant use, in order to enable such use to be effected on a more rational and on a safer basis throughout the Mediterranean region.

#### Activities

1981-1983

(a) A review of the literature on the effects of oil dispersants on marine organisms will be made.

(b) The acute toxicity of available oil dispersants to selected marine organisms will be made. Both the toxicity of the dispersant itself, and of the dispersant in combination with crude oil will be studied. Organisms to be tested will include *Phaeodactylum tricornutum* (Bacillariophyta), *Artemia salina* (Crustacea), *Patella lusitanica* (Mollusca), and *Mullus barbatus* (Usteichthyes). The above species form a wide spectrum of marine life, within which *Artemia salina* has been selected both for its easy commercial availability and its reputation as a resistant species. Other species may also be tested during the period.

(c) The study of sub-lethal effects on oil dispersants will also be initiated. Such studies will include effects on:

- primary production, as measured by chlorophyll determination (*Phaeodactylum tricornutum*);
- hatching and growth rate (*Artemia salina*);
- respiration (*Patella lusitanica*);
- behaviour and respiration (*Monodonta turbinata*); and
- reproduction (*Mullus barbatus*).

(d) Preliminary studies on the acute toxicity of combinations of oil dispersants (separately and mixed with oil) and heavy metals (salts of



mercury, cadmium and copper) will be carried out on the four species listed in 3.2 above.

1984-1990

(e) The review of literature at 3(a) above will be kept continually updated.

(f) The studies on acute toxicity at 3(b) above will be extended to new dispersants as they come on the market, and to other species.

(g) The studies on sub-lethal effects at 3(c) and on combinations of dispersants and other pollutants at 3(d) will be continued and extended in the light of experience gained from the preliminary short-term phase.

(h) New studies on bioaccumulation, persistence, carcinogenicity and mutagenicity will be introduced.

#### Outputs

1981-1983

(a) Review of existing literature on effects of oil dispersants on marine organisms together with analysis vis-a-vis the Mediterranean.

(b) Report on toxicity of oil dispersants to marine organisms in the Mediterranean, based on acute tests and sub-lethal experiments.

(c) Preliminary report on the combined toxicity of oil dispersants and other pollutants.

(d) Recommendations on workplan for the period 1984-1990.

1984-1990

(e) Periodic and final reports on toxicity of dispersants alone and in combination, together with recommendations.

#### Workplan and timetable

<u>Activity</u>	<u>Timetable</u>	<u>Responsible</u>
- Designation of national institution(s) to participate in the project	April 1981	National MED POL focal point in collaboration with FAO
- Review of the available literature	May 1981- July 1983	Participating research centre

- Assistance to the national research centre participating in the project in terms of training, experts and equipment	June 1981- December 1983	FAO
- Studies on acute toxicity	June 1981- December 1983	Participating research centre
- Studies on sublethal effects	June 1981- December 1983	Participating research centre
- Studies on combined effects	January 1982- December 1983	Participating research centre
- Evaluation of the results, preparation of the report(s) and proposal for further research programme	December 1982 and December 1983	FAO in collaboration with participating research centre

Budget

The following total budget will be required for the project:

(a) MED Trust Fund contributions

	1981	1982	1983	1984-1990
1. Direct assistance to national institution(s)				
- Training	5,500	3,500	2,500	
- Experts	6,000	12,000	12,000	
- Equipment	5,000	3,000	3,000	
- Material	2,000	2,500	2,500	
2. Co-ordinating costs (FAO)	are shown as separate budget			
3. Reporting costs	-	1,000	2,000	
<b>Total</b>	<b>18,500</b>	<b>22,000</b>	<b>22,000</b>	<b>25,000</b> (per year)

(b) Estimated contributions in kind and services by the host institution will be as follows:

1. Provision of laboratory space.
2. Use of apparatus and equipment, including Gas Chromatographs, Spectrophotometers, Coulter Counter, etc.

3. One professional biologist for 15 m/m (50% of time between June 1981 and December 1983).
4. One graduate research assistant for 30 m/m.
5. Two chemists for 3 m/m each during period of 1st phase.
6. Two technicians for 15 m/m each during period of 1st phase.
7. Secretarial assistance, reagents, minor equipment, stationery and incidentals.

Items 1, 2 and 7 above cannot be converted into figures. Estimated costs of items 3, 4 and 5 and 6 are as follows (in US dollars).

Professional biologist (15 m/m)	8,500
Research assistant (30 m/m)	16,000
Two chemists (totalling 6 m/m)	5,000
Two technicians (totalling 30 m/m)	15,000
	<hr/>
TOTAL	44,500

13.2 CORRELATION BETWEEN DNA AND THE MUTAGENICITY OF THE PAH-POLLUTED ENVIRONMENT (ref. paragraph 39h of UNEP/WG.46/4). Received from FAO : 1 October 1980.

### Introduction

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 germline 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 cell- and organismic disease, precocious aging, formation of neoplasia and death. Both germ-line and somatic mutational effects may result in ecologically most severe event -- the extinction of species and disbalance of the ecosystem as a consequence. It is obvious that for our understanding of the marine environment, for our decision-making processes or for our legislative measures we need information on the potential ecological hazards generated by the presence of mutagens in the marine environment.

At present our knowledge in this field is rather poor. The reason for this may be the fact that 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. Therefore our approach to this problem stems from the observations of correlated activities common to many agents causing mutation — the effects on the desoxyribonucleic acid molecule. The damage of DNA molecule 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) and (b) genetic (somatic cell transformation, carcinogenesis, mutation, hereditary instability, selection of mutants, death).

Therefore the quantitative measurement of damage in the DNA molecule of exposed organism should theoretically bring a parameter for the estimation of the effects of mutagenic substances present in the marine environment. In order to prove this statement, the quantity of damaged DNA should correlate with the quantity of mutagenic substances in the water (dose-response). The quantity of these substances should be quantified both chemically and biologically (mutatesting).

### Objectives

The aim of this programme is to investigate the expressivity and correlation of mutagenicity and DNA strand-breaks under the conditions of actual pollution.

The short-term objective is to correlate PAH-pollution, mutagenicity and DNA strand-breaks in exposed organisms.

The long-term objective is to assess the mutagenic risk of marine ecosystem caused by the presence of genotoxic PAH-pollutants.

### Background information

Some preliminary investigations have shown that PAH are present in the Mediterranean waters at the levels which permit the detection of their toxic effects on the organismic (Salmonella-Ames test) and the molecular (induction of detoxifying enzymes, damage of DNA) level. However PAH express these effects only after metabolic (in fish, crabs, helminths) or physico-chemical transformation. Thus, BaP in the form of ultimate cancerogen may become available also to other organisms of the biotope, even to those that do not dispose of the capability of activation. Investigations in the past have shown further that DNA of those organisms that can activate BaP by themselves or those that have been exposed to activated BaP-derivatives, has acquired a significant number of single-strand breaks as compared to DNA from unexposed control organisms. So far no case has been observed where biological activity and DNA-nicking were dissociated.

## Activities

- Samples of water and sediment collected at typical sites, i.e. polluted and unpolluted, will be extracted with hexane, cyclohexane and XAD-2. The concentrates will serve for chemical and biological analyses.
- The field organisms will comprise the representatives of those lacking the bioactivating enzymes (sponges *Geodia* and *Tethya*) and others having the capability to bioactivate precancerogenic PAH (*Blennius pavo*, as a representative of small-territory stationary fish, and *Sardina pilchardus*, as a representative of pelagic fish). Exploration of other suitable organisms is envisaged (*Mytilus galloprovincialis*, Helminths).
- The laboratory test organisms will be a population of F1-generation of young carp, *Gambusia* both fresh and sea-water, *Geodia* and *Tethya*. Several strains of *Salmonella typhimurium* will be used in mutatesting.
- Chemical quantification and identification of PAH present in water concentrates will be done by TLC as far as possible.
- A set of biological tests will comprise:
  - a) "Induct-test" — the measurement of the induction of benzo(a)pyrene monooxygenase activity in carp and *Gambusia* after i/p application of millieu exposure to concentrates;
  - b) Estimation of the status of BaP monooxygenase activity in fish, crabs and ~~helminths collected at typical sites~~;
  - c) Tests for mutagenicity with strains of *Salmonella*;
  - d) Estimation of DNA-damage by measuring the DNA-single breaks using the DAPI-method (field and laboratory material);
  - e) Estimation of DNA single or double breaks by elmicroscopical method after purification of DNA from both field and experimental material. This is an absolute method and it will be used for calibration of other methods;
  - f) "Transplantation" experiments — the control organisms will be transferred to polluted sites, exposed for a time and analysed by a set of biological parameters (a - e). The same transfer will be done in the opposite direction.

## Outputs

1981-1983

- Report on the correlation of PAH-pollution, mutagenicity and DNA strand-breaks in exposed organisms under laboratory conditions.
- Report on the possibility of extrapolation of used tests from laboratory experiment to field conditions and the development of the respective methodology.

The basic achievements from the first period will enable the execution of the workplan in the next period (1984-1990) aimed at the assessment of the level of PAH-pollution, DNA-damage and the general healthy state of organisms and populations.

1984-1990

- Periodic and final reports on the correlation of the levels of PAH-pollution and DNA damage as well as on the general healthy state of selected (representative) organisms and populations.

## Workplan and timetable

<u>Activity</u>	<u>Timetable</u>	<u>Responsible</u>
- Designation of the national institution(s) to participate in the project	April 1981	National MED PUL focal point in collaboration with FAO
- Assistance to the national research centre(s) participating in the project in terms of training, experts and equipment	June 1981 to December 1983	FAO
- Fieldwork (sampling water and sediments)	June 1981 to July 1983	National research centre
- Laboratory tests	June 1981 to December 1983	National research centre
- Evaluation of results, reporting and proposal for future work	December 1983	FAO in collaboration with participating research centre

Budget

(a) Contribution from the MED Trust Fund

	1981	1982	1983	1984-1990
1. Direct assistance to national institutions(s)				
- Training	4,000	4,000	3,000	
- Experts	4,000	8,000	8,000	
- Equipment	8,000	6,000	4,000	
- Material	2,000	2,000	2,000	
2. Co-ordinating costs (FAQ)				are shown as separate budget
3. Reporting costs	-	-	2,000	
4. Miscellaneous	1,000	1,000	1,000	
<b>Total</b>	<b>19,000</b>	<b>21,000</b>	<b>22,000</b>	<b>25,000</b> (per year)

(b) Contribution of the organization proposing the project:  
(indicates average costs per year)

- Personnel  
(4 senior scientists, 6 scientists, 2 technicians)
- Operating costs of major equipment
- Other costs  
(secretarial assistance, minor equipment, reagent, stationary etc.)

13.3 RESEARCH ON THE EFFECTS OF PCBs ON MARINE ORGANISMS (ref. paragraph 39h of UNEP/WG.46/4). Received from FAO : 1 October 1980.

Objectives

The basic aim of this project is to contribute to the knowledge about effects at low level and over longer periods of PCBs to selected marine organisms.

(a) Short-term objectives (1981-83)

To determine, at a preliminary level, sub-lethal effects of PCBs on selected marine organisms to provide for the formulation of a long-term programme taking into account the possible combined effects of PCBs and other pollutants in coastal waters.

(b) Long-term objectives (1984-1990)

To determine as accurately as possible, and on a continuing basis, sub-lethal effects of PCBs including chronic toxicity, persistence, bioaccumulation and eventually cancerogenicity and mutagenicity, in order to provide information on the hazards to marine life in the Mediterranean arising from the pollution with PCBs.

Background information

Polychlorinated biphenyls (PCBs) form a class of persistent chlorinated hydrocarbons and can accumulate both in the environment and in biological material. Due to their physical and chemical properties PCBs have a wide variety of industrial applications. As they do not occur naturally in the environment all levels can be attributed to man's activities. The major source of pollution with PCBs is the leakage and disposal of industrial fluids but also the atmospheric fallout is expected to play an important role. Generally PCBs are highly resistant to biodegradation and are accumulated to a high degree by marine organisms.

Results from the monitoring of PCBs in marine organisms during MED POL - PHASE I show that the concentrations are varying considerably, often by several 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.

Activities

A review of the literature on the effects of PCBs on marine organisms.



Development of methods for studies on the effects of PCBs under laboratory conditions will be developed. (Several technical difficulties arise due to the nature of PCBs).

Studies of sub-lethal effects of PCBs on suitable species of mussels (*Mytilus galloprovincialis*) crustaceans (*Artemia salina*, *Palaemon elegans*) and fish (*Mugil* sp.). This will inter alia include development of eggs and larvae of *Mytilus galloprovincialis*, hatching of *Artemia salina* and *Palaemon elegans* and reproduction of *Mugil* sp.

Studies of accumulation of PCBs in the above mentioned organisms at environmental levels.

### Outputs

The following outputs are envisaged for the period 1981-1983:

- Review of existing literature on effects of PCBs on marine organisms.
- Preliminary reports on the toxicity of PCBs to marine organisms in the Mediterranean.
- Recommendations on future research for the period 1984-1990.

### Workplan and budget

Activity	Timetable	Responsible
- Designation of national institution to participate in the project	April 1981	National MED Pol focal point in collaboration with FAO
- Assistance to the national research centre participating in the project in terms of training, experts and equipment (material)	June 1981- December 1983	FAO
- Laboratory tests and analyses	July 1981 to June 1983	Participating research centre
- Evaluation of results and preparation of report and programme for future work	November- December 1983	FAO in collaboration with participating research centre

Budget

The following total budget will be required for the project.

(a) Estimated contribution for the MED Trust Fund

	1981	1982	1983	1984-1990
1. Direct assistance to national institution(s)				
- Training	4,000	3,000	2,000	
- Experts	6,000	8,000	8,000	
- Equipment	5,000	5,000	4,000	
- Material	2,500	3,000	2,000	
2. Co-ordinating costs (FAO)	are shown as separate budget			
3 Reporting costs	-	-	2,000	
4. Miscellaneous	2,000	2,000	2,000	
<b>Total</b>	<b>19,000</b>	<b>21,000</b>	<b>20,000</b>	<b>25,000</b> (per year)

(b) Contribution from the participating institute:

- Personnel (senior scientists, scientists, technicians).
- Provision of laboratory space and use of equipment.
- Other costs (secretarial assistance, minor equipment reagents, stationery).

An indicative figure of the average costs for personnel per year for this contribution would be about US dollars 40,000 to 60,000.

13.4 CONTAMINANTS IN RESIDENT AND MIGRATORY BIRDS (Ref. paragraph 39h of UNEP/WG.46/4). Received from an individual scientist : 13 October 1980.

### Objectives

The objective of the proposed project is to study the levels and effects of selected contaminants in resident and migratory birds around the Mediterranean, with particular reference to contaminants which may have their origin in the seafood consumed by these birds.

### Background

Around the world the study of contamination in birds has been quite high in the last two or three decades. Very little information for the Mediterranean area is available so far. Among the few scanty reports we might recall those concerning some shore birds in the Adriatic, sea-gull and stern near an anthropogenic mercury source of the Tyrrhenian Sea, and in a few sea-gulls and raptors in the Western Mediterranean Sea.

The results obtained in the pilot projects of MED POL II and III have clearly indicated the high levels of mercury in many marine organisms (and consequently in "fish-eating" birds) and the continuous increase of PCBs in the same organisms near heavily industrialized areas.

In some species such as the opportunistic sea-gull *Larus a.m.* the food habit has greatly changed during the last decades and therefore their use in pollution monitoring is extremely important. The same applies for various "true" fish-eating species and some resident seed-eating species living near marshes and lagoons, and many others.

### Activities

Monitoring of selected trace metals and chlorinated hydrocarbons in a few resident marine (*Larus argentatus michaelis*) and fresh-water (*Larus a.m.*, *Fulica atra*) species. Preliminary surveys of some representatives of migratory birds (*Sterna allifrons*, *Anser a.*). Determination of inorganic and organic mercury in the various organs and tissues to establish the flux throughout the food-chain (water - fishes, crustaceans, molluscs - birds). Evaluation of the reproduction failure in these species (or specimens) where adults and/or eggs contain contaminants in concentrations well above the "background" level.

Eggs, feathers, and, for some common and not endangered species, liver, muscle, kidney and brain will be collected and analyzed for Hg, Cd, Pb, Se and other important trace metals and for DDT, DDE, PCB and other common chlorinated hydrocarbons.

Workplan and timetable

1981-1983

- Review of the available data on birds and eggs collected near natural mercury anomalies (cinnabar deposit areas) and near anthropogenic sources.
- Review of the available data on other trace metals, with particular interest on selenium correlated to the mercury concentrations in the animal body.
- Review of available data on chlorinated hydrocarbons and estimation of the impact of these contaminants on the reproductive cycle of the studied birds.
- Evaluation of the transfer of contaminants by migratory birds having their winter quarters in areas with low industrialization and their reproductive quarters in areas with high industrialization, and vice versa.

1984-1990

Further evaluation of the level of contaminants in tissues and organs of birds with different food habits and with a different system of life (resident or migratory) should give, to the end of the project, the following answers:

- (a) the flux of several common contaminants throughout the food chain (water: crustaceans, molluscs; fishes: birds);
- (b) the levels of common contaminants in resident species of a given area, island or section of a continent; indirectly the level of pollution in that environment;
- (c) the levels of contaminants in migratory species, which spend their life in areas with various degrees of pollution;
- (d) the influence of one or more contaminants on the reproductive activity and success.

Tentative budget (in US dollars)

	1981	1982	1983
Training	3,000	-	-
Experts	4,000	4,000	5,000
Co-ordination and meeting costs	3,000	3,000	4,000
Material, expeditions for collection, analysis of sampling	12,000	15,000	15,000
Total	22,000	22,000	24,000

#### 14. RESEARCH ON EUTROPHICATION

14.1 STUDY OF EUTROPHICATION PHENOMENA WITH EMPHASIS ON IRREGULAR PHYTOPLANKTON BLOOMS (ref. paragraph 391 of UNEP/WG.46/4). Received from FAO : 1 October 1980.

##### Objectives

The following goals can be achieved by the proposed project:

- to produce an inventory of eutrophied Mediterranean coastal waters providing for each case a review of historical data on evolution, causes and structure of particular eutrophication process;
- to investigate levels, periodicity, causes and ecosystem structures of open waters of the North Adriatic and the Gulf of Lyon as the areas in suspect to be highly eutrophied;
- to provide information on appearance, taxonomic structures and eventual toxicity of red-tides and irregular phytoplankton bloom;
- to initiate experimental investigations on quantitative relationships between productivity and structure of eutrophied communities, as well as on levels and compositions of pollution born abiotic factors as the basis for future ecomathematical approaches leading towards national environmental managements.

##### Background information

Scientific sources and 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, which environment is heavily eutrophied, possibly anoxic and consequently even azoic. In all these cases the major causes are increased levels of pollution-born nutrients and accordingly high production of a number of supertolerant pelagic and benthic algae. The following localized cases of eutrophication can be pointed out: the Lake of Tunis, the Bays of Izmir (Turkey), Athens (Greece), Kastela and Koper (Yugoslavia), lagoons in the region of the Nile Delta etc. Although most of locally eutrophied environments could be restored back to almost natural conditions simply by the appropriate hydro and biochemical measures a descriptive inventory is essential as a basis for national pollution abatement plans.

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

However, the complexity of offshore marine environment, natural oscillations and lack of long-term series of ecological observations hinder an adequate scientific understanding of these processes and a national planning of eutrophication controlling measures. Therefore advanced investigations as proposed in this project, linked to the project on ecosystem modifications and using relevant outputs of long-term monitoring programme are certainly needed in the frame of priority actions for environmental protection of the Mediterranean Sea.

#### Activities envisaged

The programme consists of the following aspects of investigations:

(a) State and appearance of localized eutrophications in Mediterranean coastal waters.

National research centres which collaborated in the pilot project MED POL V, as well as other Mediterranean institutions and individual scientists, will be invited to contribute with updated information on eutrophication cases in particular regions they are familiar with. In addition compilation of information as available in scientific literature will be made. If needed specialists will make field observations of particular eutrophication cases in order to complete relevant information. On the basis of above data a group of experts should prepare a descriptive inventory of Mediterranean coastal eutrophication cases.

(b) Investigations on large-size eutrophication processes in open waters of the North Adriatic and the Bay of Lyon.

Institutions and scientists who are actively involved in bio-oceanographic research of pelagic ecosystems of above mentioned areas shall be invited to contribute cooperatively to the following topics:

- Compilation of available data on previous environmental conditions relevant to the evolution of eutrophication processes (such as levels and oscillations of energy, optical conditions nutrients, organic matter, distribution and circulation of water-masses etc.) and presentation of phytoplankton standing crops, taxonomic compositions and productivity as the trends.
- Actual investigations of conditions as mentioned above in the frame of the project on ecosystem modifications and specific research on the appearance, structure and consequences of irregular phytoplankton blooms and red-tides.

- Review of available previous data and outputs from long-term monitoring programme on amounts and dynamics of nutrient discharges from terrestrial sources and preparation of relevant trophic budgets.
- Synthetic and critical evaluation of all information obtained in order to estimate the levels and trends of an eventual overall eutrophication as well as the principal causes.

(c) Experimental investigations

- Isolation of axenic monocultures of dominant phytoplankton species responsible for irregular blooms and red-tides.
- Studies of population dynamics of above species growing in natural conditions and their response to pollution-born environmental modifications as they appear in investigated areas now and as they can be expected in the next future provided trends will remain such as they are.

Outputs:

- (a) An inventory, with comprehensive descriptions of significantly eutrophied coastal environments of the whole Mediterranean.
- (b) Analysis of evolution, state, structure, causes and consequences of large-size eutrophication processes in the North Adriatic and the Gulf of Lyon.
- (c) Bank of monocultures for algae species responsible for outbreaks of red-tides and phytoplankton blooms.
- (d) Preliminary results of experimental research on algae productivity in pollution-enriched environments.

Workplan and timetable

Activity	Timetable	Responsible
- Designation of national participating institution(s)	January 1982	National MED Pol focal point in collaboration with FAO
- Assistance to the national centre(s) participating in the project in terms of training, experts and equipment	March 1982- December 1983	FAO
- Meetings	July 1982 July 1983 December 1983	FAO in collaboration with national research centres
- Investigations of coastal eutrophication	July 1982- May 1981	National research centre(s)
- Investigations of selected areas	July 1982- December 1983	" "
- Experimental investigations	December 1982- December 1983	" "
- Evaluated inventory of coastal pollution	September 1983	" "
- Report on experimental results	October 1983	" "
- Evaluation of results, reporting and submission of proposal for future work	December 1983	FAO in collaboration with national research centre(s)



Budget

(a) Contribution from MED Trust Fund

	1982	1983	1984-1990
1. Direct assistance to national institution(s)			
- Training	8,000	6,000	
- Experts	15,000	10,000	
- Equipment	24,000	22,000	
- Material	6,000	6,000	
- Services	1,000	2,000	
2. Meetings			
- Initial meeting of participating experts (July 1982)	10,000	-	
- Expert meeting for the evaluation of eutrophication inventory (July 1983)	-	10,000	
- Meeting for evaluation of Final Report (December 1983)	-	6,000	
3. Co-ordination costs (FAO)	are shown as separate budget		
4. Reporting costs	4,000	6,000	
5. Miscellaneous	1,000	1,000	
<b>TOTAL</b>	<b>69,000</b>	<b>69,000</b>	<b>80,000</b> (per year)

(b) Contribution from the participating research centre(s)

- Provision of laboratory space
- Operating costs of major equipment (including vessels)
- Personnel (scientists and technicians)
- Other costs (secretarial assistance, minor equipment, chemicals)

## 15. STUDY OF ECOSYSTEM MODIFICATIONS

15.1 STUDY OF POLLUTION INDUCED ECOSYSTEM MODIFICATIONS OF SELECTED MEDITERRANEAN AREAS AS THE BASIS FOR LONG-TERM ECOLOGICAL MONITORING OF THE MEDITERRANEAN SEA (Ref. paragraph 39j of UNEP/WG.46/4). Received from FAO : 1 October 1980.

### Objectives

Since the proposed project may represent the preparatory phase for a long term ecological monitoring programme of at least ten years duration its most important goal is to give scientifically justified answer whether the ecosphere of the Mediterranean Sea as a whole face such pollution induced processes which may lead to large-size modifications of its metabolism in directions of bioproductivity inhibition or an overall eutrophication and to show which are the zones of the Mediterranean Sea really facing above problems, what is their nature and how they can be controlled by environmental protection.

In order to develop a long-term monitoring of ecosystem modifications the following objectives are envisaged as part of this project:

- (a) Selection of a few pilot zones, preferably in areas with existing historical records on changes of ecosystems under the influence of man's activities.
- (b) Analysis of the present ecological conditions in the selected pilot zones and their comparison with those observed in the past.
- (c) Study and harmonization of sampling, sample processing and data evaluation procedures which may yield an appropriate indication on ecosystem changes, including an indication on the cause/effect relationship between pollution and the observed changes in the ecosystems.
- (d) Training of regional experts in subjects mentioned in (c).
- (e) Development of a long-term programme for ecological monitoring based on the results of the projects.

### Background information

During the last ten years we are faced with a growing concern of

governmental and professional institutions and particularly of the public about quite dramatic ecological phenomena such as large-size eutrophications accompanied by red-tide outbreaks, fish and molluscs mass-mortalities etc. which appear periodically in some Mediterranean areas. Scientific sources and particularly results provided by pilot project MED POL V fully support the conclusions that these phenomena are combined effects of increasing pollution loads and fluctuating natural hydrological conditions. Moreover public and scientists are reporting on gradual disappearance of sea-grass beds, macro-algae communities and of with them associated fin-fish populations. On the contrary some large invertebrate species such as sea-urchins (*Paracentrotus lividus*), mussels (*Mytilus galloprovincialis*), introduced exotic oysters (*Crassostrea gigas*), scyphomedusae (*Pelagia noctiluca*) are "explosively" enlarging their populations and disturbing some activities such as recreational use of coastal waters, and of course contributing in a major grade for development of some ecological disequilibria. Whether these phenomena can be attributed to pollution effects or not remains open to further investigations.

These are just a few examples which indicate that pollution is essentially a biological phenomenon and that its assessment inherently requires corresponding approach, i.e. primarily the monitoring of changes in ecosystems. Also it should be stressed that detection and assessment of pollution effects through investigations of ecosystems have in principle a greater potential for relevant and valid interpretations than ~~physico-chemical or bacteriological approaches~~. Ecosystems provide records of prevailing conditions over longer periods of time since they are relatively insensitive to temporary fluctuations in the environment as well as to changing rates and compositions of pollutants.

Ecosystem investigations should therefore be made part of the pollution monitoring and research programme and should be envisaged during the MED POL - Phase II. Unfortunately the complexity of ecosystems in general, some actual methodological problems and scarcity of specialized research teams in the Mediterranean regions are hindering an immediate action for systematic ecological monitoring which should cover the whole area. Herewith proposed activities are therefore considered as a research of a short duration (1989I-83) and for a limited area of investigations (N and SW Mediterranean), which may be followed by a regular ecological monitoring programme for the whole Mediterranean.

#### Activities envisaged

The work would be carried out by national institutions interested in participating in the proposed projects. FAO would be ready to provide for the co-ordination of the envisaged work.

Tentatively it is proposed that the following pilot zones are selected:

- (a) zones under heavy influence of pollutants:

- North Adriatic: western and eastern coastal zone
- Gulf of Lyon: east and west-wards of the Rhone Delta

(b) "Clean" reference zones:

- South western Mediterranean: coastal waters of Algeria

From each of the characteristic area a permanent transect with an adequate set of stations would be selected in accordance with the following prerequisites:

- to be ecologically representative for that area and located as far away from local pollution sources as possible and practical. In addition, but facultatively, the research centres will be invited to monitor a comparable transect located in the same area but under direct influence of local pollution sources;
- to reach offshore pelagic environment (3-5 Nm) and to cross optimally the following benthic communities: hard bottom medio and infralittoral communities, prairies of sea grasses (*Posidonia*, *Cymodocea* etc.) and inshore sandy, muddy and detritic soft bottom assemblages.

Benthic communities would be sampled and studied twice a year (summer-winter), the physico-chemical properties of sedimentary substrates would be determined once in 3 years.

Pelagic ecosystem would be monitored at least with monthly frequency, weekly during blooming conditions, always approximately on synoptic terms at all transects.

The following indicators (parameters) would be followed in all three selected zones:

(a) Environmental conditions

- Basic climatic conditions in the atmosphere of the investigated areas as obtainable from meteorological services or measured by the research team independently.
- Surface radiation energy information obtained as above and measurement of photosynthetic spectral range in depth profiles.
- Turbidity as Secchi obligatory and actual optical measurements in surface, thermocline and near-bottom layers facultatively.
- Water temperature and salinity depth-profiles.
- Oxygen, pH, alkalinity and calculated total free  $\text{CO}_2$  in surface, thermocline and near-bottom layers.

- Indicative nutrients as  $PO_4$ ,  $N-NO_3$  and  $Si-SiO_2$  in surface and near bottom layers.
- Total seston and its organic fraction in surface and near-bottom layers.
- Extractable total mineral-oil, lipids and anionic detergents in subsurface and near-bottom layers, facultatively.
- Specific records or eventual man-induced changes of the environment in the investigated area which appeared during the period of the project.

(b) Pelagic bioproductivity and communities

- Biomass of primary producers as chlorophyll content of sequence-mixed samples from surface, medium and light-limited layers; functional carbon assimilation facultatively.
- Total and dominant species density of phytoplankton in samples as above; phytoplankton community structure and diversity facultatively.
- Total density of heterotrophic bacteria as plate counts from samples as above, and direct fluorescence counts and AIP facultatively.
- Zooplankton biomass and density of dominant species from vertical hauls; zooplankton community structure and diversity facultatively.
- Records on specific phenomena in pelagic environment such as phytoplanktonic blooms, red-tides, out-breaks of larger pelagic organisms, mass-mortalities, changes of pelagic fish populations, migrations, etc.

(c) Benthic communities and productivity of their dominant components:

- Biomass and its fractions: Total macrophyta (algae, sea grasses) to be sampled by monthly frequency at least in medio and infralittoral; Dominant macrophytic species to be sampled by monthly frequency at least in medio and infralittoral; Total macrofauna and dominant species of macrofauna.
- Abundancy and population dynamics of dominant species of macrophyta and macrofauna.
- Comprehensive analysis of structure and diversity of communities, facultatively.
- Records on disappearance of new settlements of particular species.

(d) Sedimentological information on granulometry, mineralogical composition, carbon and carbonate content and other geochemical data such as P, N, Fe, Mn content facultatively.

Outputs

- (a) In depth analysis of the ecosystems in the selected zones and the factors which may have influenced these modifications in the past.
- (b) Analysis of the cause/effect relationship between the observed ecosystem modification and the factors which might have contributed to these modifications.
- (c) Methodology suitable for the analysis of ecosystem modifications.
- (d) Scientific justification for a large scale study of ecosystem modifications and the formulation of a project for long-term monitoring of these modifications.

Workplan and timetable

Activity	Timetable	Responsible
- Designation of national institutions to participate in the project	March 1982	National MED Pol focal points in collaboration with FAO
- Meeting of representatives of institutions designated to participate in the project to develop the methodological concept of the project	July 1982	FAO
- Field work according to procedure agreed at meeting above	September 1982- December 1983	Participating national research centre
- Assistance to the institutions participating in this project in terms of experts and equipment	September 1982- December 1983	FAO
- Evaluation of the project results, reporting and proposal for the future work	December 1983	FAO with co-operation of participating national institutions

Budget

(a) Contribution from MED Trust Fund

	1982	1983	1984-1990
1. Direct assistance to national institutions:			
- Training	6,000	10,000	
- Experts	5,000	10,000	
- Equipment	11,000	29,000	
- Material	2,000	4,000	
- Services	1,000	1,000	
2. Meetings			
- Initial meeting of collaborating experts (July 1982)	6,000	-	
- Meeting for evaluation of results (December 1983)	-	9,000	
3. Co-ordination costs (FAQ)	are shown as separate budget		
4. Reporting costs	3,000	5,000	
5. Miscellaneous	1,000	1,000	
Total	35,000	69,000	100,000 (per year)

(b) Contribution from participating research centres

- Provision of laboratory space
- Operating costs of major equipment (including vessels)
- Personnel (scientists and technicians)
- Other costs (secretarial assistance, minor equipment, chemicals)

## 16. EFFECTS OF THERMAL DISCHARGES

### 16.1 EFFECTS OF THERMAL DISCHARGES ON COASTAL ORGANISMS AND ECOSYSTEMS (ref. paragraph 39k of UNEP/WG.46/4). Received from FAO : 1 October 1980.

#### Objectives

The objectives are as follows:

- Evaluate the short-term effects (mortality rate) and eventually long-term effects (perturbation of the life cycle such as reproduction, growth etc.) of the thermal choc on selected species.
- Determine the repercussion of thermal discharge on marine communities and ecosystems (elimination of the species, replacement).
- Determine the possibilities to use thermal discharges for breeding and raising selected marine animals.

#### Background information

Thermal discharges represent for the marine environment disturbing and/or beneficial factors where their importance depend 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 choc, mechanical choc, 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, are also expected to be found.

The disturbing effects of thermal discharges are at present evident in different coastal areas of the world however in the Mediterranean these problems are less evident for the following reasons:

- The actual power stations are of small size and their thermal spot is relatively localised.
- Their functioning is not continuous and
- Nearly all the stations are situated in the areas influenced also by domestic and industrial pollution.



However the thermal discharges are expected to increase in the future and therefore some initial research on their disturbing and/or beneficial effects should be done accordingly.

Activities envisaged

The following studies are envisaged:

(a) Effects on plankton ecosystem

This is apparently the most disturbed system which should be studied as follows:

in situ

- Qualitative and quantitative distribution of phytoplankton and zooplankton before entering the power station and immediately after the water is discharged.

- Plankton evolution in the thermal spot

in vitro

- Laboratory experiments on plankton submitted to thermal choc, chlorination and to combine effects of different pollutants present in the disturbed environment.

(b) Effects on benthic communities

- Study of benthic communities within the thermal spot compared with similar zone not disturbed.

- Biological studies on sessile, and less mobile species regarding their life cycle and physiological and biochemical repercussion in relation with the elevated temperature and in relation with other pollutants such as chlorine.

- The species selected will be those found as fouling organisms in cooling systems of the power stations (Hydroids, Serpulids, Mussels, etc.).

- The possibility to perform research in vitro such as reconolisation of the solid and soft bottoms will also be considered.

(c) Effects on necton

Some preliminary studies will also be performed on injured and "ill" fish which appear in thermal discharges spot.

(d) Beneficial effects on selected marine species

Some preliminary studies will be made to obtain information on early and/or "continuing" breeding and quicker growth of the selected marine organisms.

Outputs

- (a) Review of the existing bibliography and other information on effects of thermal discharges with special emphasis to the Mediterranean.
- (b) Report on short-term effects of thermal discharges on selected species (in situ and in vitro).
- (c) Preliminary report on some long-term effects on selected species and communities.
- (d) Preliminary report on possibilities to raise molluscs and fish.
- (e) Proposals for the future work.

Workplan and timetable

Activity	Timetable	Responsible
- Designation of national institution to participate in the project	January-March 1983	National MED Pol focal point in collaboration with FAO
- Assistance to the research centre in training, experts and equipment	January-December 1983	FAO
- Studies on short-term effects	April 1983	Participating national institution
- Initial studies on long-term effects	June 1983	Participating national institution
- Initial studies on raising molluscs and fish	June 1983	Participating national institution
- Evaluation of results preparation of report and proposal for future research	November-December 1983	FAO in collaboration with the participating research centre

Budget

(a) Contribution from MED Trust Fund

	1981	1982	1983	1984-1990
1. Direct assistance to national institution(s)				
- Training	-	-	3,000	
- Experts	-	-	8,000	
- Equipment	-	-	4,000	
- Material	-	-	2,000	
2. Meetings	-	-	-	
3. Coordinating costs (FAU)	are shown as separate budget			
4. Reporting costs	-	-	1,000	
5. Miscellaneous	-	-	-	
<hr/> Total	-	-	18,000	40,000 (per year)

(b) Contributions from the participating research centre

- Provision of laboratory space and experimental area
- Operating costs of major equipment (including boats and culturing installations)
- Personnel (scientists, technicians, fisherman)
- Other costs (secretarial assistance, minor equipment, material, chemicals)

## 17. BIOGEOCYCLE OF SELECTED POLLUTANTS

17.1 STUDIES ON THE BIOGEOCYCLE OF LEAD IN THE MEDITERRANEAN MARINE ENVIRONMENT (ref. paragraph 391 of UNEP/WG.46/4). Received from IAEA : 15 September 1980.

### Objectives

- (a) Long-term objectives: to understand the fate of lead introduced anthropogenically into the Mediterranean Sea in order to assess the impact of such inputs on human health and on marine biota.
- (b) Short-term objectives: to provide adequate scientific data for making the quantitative considerations possible on the biogeochemical cycling of lead in the Mediterranean marine environment.

### Background

Although many data have been published showing lead pollution of the coastal marine environment from industrial and urban sources, systematic studies are still inadequate on the behaviour and ultimate fate of the anthropogenic lead introduced into the sea. Since the major input of lead into the Mediterranean has known to be from the atmosphere, the geochemical behaviour of the lead can be followed by using  $^{210}\text{Pb}$ , naturally-existing isotope as a tracer of the atmospheric input. Specific activity measurements of unsupported  $^{210}\text{Pb}$  in environmental samples such as marine air, sea-water, suspended matter, sediments, biota, etc., collected from certain selected areas of the Mediterranean will give information on the time scale of the behaviour of lead in the sea.

### Activities

The first year of the studies will be devoted to developing the methodology (including the correct sampling procedures) and to determining the annual variation of stable lead and  $^{210}\text{Pb}$  in the marine atmosphere, so as to clarify the input function of these components. Selected environmental samples will also be collected and analysed to examine, in a preliminary way, the relationships existing between the various environmental matrices. In the second and third years of studies appropriate areas of the Mediterranean Sea will be chosen and systematic sampling of marine air, sea-water, suspended matter, sediments, biota, etc., will be carried out to

obtain the necessary data for deducing the biogeo-cycle of lead in the chosen areas. Samples collected by deploying the sediment traps will also be analysed. Especially in the third year, laboratory experiments will be carried out in order to complement the information obtained in situ on the time-scales of the various transport processes.

### Output

The progress and results of these studies will be presented at the relevant scientific meetings and in publications. The general quantitative picture of the behaviour of anthropogenic lead in the Mediterranean region will be deduced.

### Workplan and timetable

Development of the methodology	May - October 1981
Determination of the variation of atmospheric inputs	September 1981 - December 1982
Determinations on the samples systematically collected in selected areas in the Mediterranean	June 1982 - September 1983
Complementary laboratory experiments	January - September 1983
Preparation of report	October - December 1983

Budget (1981-1983)

	UNEP			IAEA
	1981	1982	1983	contribution (1981-1983)
<b>10. Project Personnel</b>				
11/12 Experts/Consultants	3,000	5,000	5,000	40,000
13. Administrative support	500	500	500	3,000
16. Travel	1,000	5,000	3,000	2,000
<b>20. Subcontract</b>				
22. Vessel operations	1,000	5,000	3,000	-
<b>40. Equipment</b>				
41. Expendable equipment	3,000	4,000	4,000	3,000
42. Non-expendable equipment	5,000	2,000	1,000	2,000
<b>50. Miscellaneous</b>				
51. Operation and maintenance of equipment	1,500	1,500	1,500	3,000
52. Reporting costs	-	500	1,000	1,000
53. Sundry	1,000	1,000	1,000	1,000
<b>Total</b>	<b>16,000</b>	<b>24,500</b>	<b>20,000</b>	<b>55,000</b>

17.2 BIOGEOCYCLES OF PATHOGENS (ref. paragraph 391 of UNEP/WG.46/4).  
Received from WHO : 6 October 1980.

Objectives

The long-term objectives of the proposed project are those described for the long-term programme for the Pollution Monitoring and Research in the Mediterranean (MED POL - Phase II) (document UNEP/WG.46/4).

The specific objectives are:

- to survey the possible biogeocycles of pathogens as a complement to the

epidemiological study, proposed under another Project (Ref. ....).

- to assess the impact of these pathogens on human health.
- to estimate the survivability of selected pathogens and the possibilities of relevant contamination.

### Background

Pathogenic bacteria, viruses, chlamydia, fungi, protozoa and parasites are often transferred to the Mediterranean via wastes, rivers and surface water run-off. Other pollution sources include bathers and animals. The ambient atmosphere may also play a role in the diffusion of pollutants. Mainly river outlets and sewage water effluents influence hygienic conditions of an important part of the population in the area (approximately 300,000) especially in coastal zones.

The Mediterranean is an exceptional position due to its intensive use by about 100 million people, as a recreational area. Tourism is closely linked to the coastal environment, and the hygienic quality of recreational beaches, bathing waters and marine food influence the prevalence of certain infectious diseases, not only in the Mediterranean countries themselves, but also in those countries not adjacent to the Mediterranean from which tourists come. Some investigations clearly illustrate these relationships. In some non-Mediterranean countries, imported cases of salmonellosis and shigellosis appear to be clearly related to recreational activities around the Mediterranean.

Consequences of pollution by pathogens in the Mediterranean area will be determined by the actual hygienic barriers including bathing factors, food hygiene, diet as well as climatic conditions, movement and intermingling of populations and the immunological and nutritional status of the population at risk.

The infection chain resulting from pollution may be diagrammed as follows:

man/animal — wastes — the Mediterranean coastal waters — fish, crustaceans, shellfish — man/animal.

This infection chain schematically points out the possibilities for multiplication and spread of pathogens through biogeo-cycling. The chain may be supplemented by the possibility of cross-contamination from marine food and other food items in private or public catering establishments.

The biogeo-cycles of pathogens are also decisively influenced by the survival and multiplication of organisms in waste water, surface water, sea water and food. The sea water multiplication of pathogens will not normally take place, apart from some pathogenic *Vibrio* and perhaps *C. botulinum*. Accumulation or concentration may occur in shellfish and or fish gills. In the sea, pathogens will be prevented from concentrating by

the balance between initial contamination, dilution, sedimentation and the continuous impact of biotic and abiotic factors.

The vectors available for cycling of bacteria, viruses and parasites include the travelling and resident populations, animals, food and feedstuffs. The spread is enhanced by consumption of raw or insufficiently cooked sea-urchins, mussels, oysters, clams and fish.

The low standards of living and hygiene and the local prevalence of water-borne and food-borne diseases are factors of concern.

It must be pointed out that some imported pathogens may well be spread to temperate zones, but may not become established in these zones because of certain requirements of temperature, vectors, etc. Such diseases will generally remain a problem if the individual traveller is infected, and can spread if the traveller happens to be a food-handler.

Contaminated marine foods are primarily responsible for the spread of gastrointestinal pathogens. Polluted sea water may be involved in a more broad spectrum of additional hazards such as skin and wound infections, infections of the eyes, ears, nose and throat, and the respiratory system. More precise information on biogeocycle of pathogens is required.

This project will be closely related to some other proposed projects, including those concerned with epidemiology and those related to Article 7 in the Protocol for the protection of the Mediterranean sea against land-based sources. Moreover, the project will provide an essential support to the related projects.

The results of the Pilot Phase of MED PUL have provided an initial picture of the microbiological pollution of the Mediterranean. These results may also be useful for the proposed project.

#### Proposed activities

(a) For the period 1981-1983

1. A critical review of existing literature dealing with biogeocycles of pathogens including survival, transmission and spread in polluted sea water, with special reference to the Mediterranean and based on related health hazards.
2. A critical review of existing literature dealing with diseases associated with travel, with special reference to the Mediterranean, and assessment of further consequences of infection.

Activities 1 and 2 will be carried out on a contractual basis by a competent institute or a consultant. Moreover, they will be correlated with the proposed project "Development of environmental quality criteria with particular reference to epidemiological studies" (see Project 2 herewith included).



3. Collaborative regional investigations on the impact of biogeocycled pathogens on human health.

This activity will include monitoring of selected pathogens in marine water, including swimming pools fed by sea water, in marine sediments, and marine foods, for identifying the most important pathogens in biogeocycles and for identifying the spread of pathogens.

Here again, close collaboration and co-ordination with the proposed project on "Development of environmental quality criteria with particular reference to epidemiological studies", will be necessary.

This activity will be carried out with the participating national collaborating laboratories and the assistance of a technical co-ordinator

4. Meetings

Annual consultation between national scientists in relevant disciplines responsible for carrying out the national components of the project will take place. They are intended:

- to stimulate participation of the various Mediterranean countries
- to ensure harmonization of inputs
- to review and agree on remedial or adjustment measures.
- to evaluate results and plan for the future

These annual meetings are intended to also cover the needs of interrelated projects within the long-term programme. Similarly, other meetings of some nature planned in the long-term programme may cover the above objectives. In these cases appropriate arrangements will be made in order to avoid unnecessary duplication.

5. Training and Technical assistance

A number of Mediterranean countries, particularly developing countries, will require varying degrees of assistance, particularly in the aspects of personnel training and exchange of knowledge and experience through direct contact. This will enable them to provide the required national inputs in the project and to develop the necessary national service and competence. Furthermore, it will also be necessary to develop training in standardized methodologies in order to promote comparability of results.

A limited amount of equipment especially expendable material aiming at promoting accuracy and comparability of results is also intended to be provided to the participating national laboratories nominated by the National Focal Points.

(b) For the period of 1984-1990

1. Consideration of the feasible inclusion of biotoxin in the proposed a.1 activity. On-site investigation will be conducted as to the survival of selected pathogens in the Mediterranean coastal area.
2. Continuation and expansion of activity proposed in a.3, based on experience gained during the first period of the long-term programme.
3. Study of the influence of changed patterns of waste handling on biogeocycles of pathogens and microbiological contamination of coastal areas.

#### Output

(a) For the period of 1981-1983

1. Interim evaluation of health hazards related to biogeocycles and spread of pathogens, including assessment of factors influencing these biogeocycles. This evaluation will include:
  - Health hazards related to bathing in the area.
  - Health hazards related to marine foods in the area.

(b) For the period of 1984-1990

1. Evaluation of survival of selected pathogens in the Mediterranean coastal areas.

#### Workplan and timetable

The implementation of this work plan is subject to the availability of funds for each activity proposed.

#### Activities

	Starting and Ending (from month 0)	
a.1	1 - 4	
a.2	1 - 4	
a.3	4.5 - 5	
a.3	8 - 26	
Meetings	20.5 - 20.75	one week duration
"	5 -	four days duration
"	17 -	four days duration
"	29 -	four days duration

Tentative Budget (in US dollars)

	1981	1982	1983	1984-1990
Experts	3,000	12,000		
Sub-contract	25,000			
Equipment	15,000	15,000		
Training	2,000	5,000	5,000	
(i) Direct assistance	43,000	27,000		
(ii) Meetings*	4,000	4,000	19,000	
(iii) Co-ordination	7,000	5,000	4,000	
(IV) Reporting cost	3,000	3,000	3,000	
(v) Miscellaneous	1,000	1,000	1,000	
Total	60,000	45,000	32,000	40,000 (per year)

\*It is proposed to organize an annual meeting for stimulating, reviewing, evaluating and adjusting work undertaken by related projects. The estimated cost (\$4,000) per year represents the share of the present project to the total cost of these meetings.

17.3 IMPACT ASSESSMENT OF MERCURY THROUGH A STUDY OF THE BIOGEOCHEMICAL CYCLES OF MERCURY AND SELENIUM (ref. paragraph 391 of UNEP/WG.46/4).  
Received from FAO : 30 October 1980.

Objectives

- (a) Long-term objectives: the construction of a mathematical model of the biogeochemical cycles of Hg and Se under the influence of a natural Hg geochemical anomaly near a coastal zone and of an anthropogenic source of Hg on the adjacent coastal zone, taking into consideration the various inputs, sources and compartments including the pathways to man. On the basis of these models and their interaction, the potential hazard for critical groups and for general human population of the higher than average Hg concentration in marine food, will be assessed.

(b) Short-term objectives (1981-1983) : Construction of a preliminary mathematical model of the Hg cycle on the basis of available data and identification of missing (or insufficient) data. In a first approach only the cycle of total Hg will be considered.

- Determination of inorganic and organic Hg in the most important components and fluxes (air, water, sediments and biota) of the model.
- Determination of Se in the most important compartments and fluxes of the Se model.
- Construction of a preliminary Se model.

### Background

The results obtained in the pilot projects MED POL II have clearly indicated that the high Hg levels encountered in several marine organisms used as food for human population could present a health hazard, at least for critical populations such as fishermen, fish vendors and similar persons who consume higher than average amounts of fishery products. The data available indicate high levels of Hg in certain very common species such as tuna, sword-fish, mullet, shrimp, etc. Furthermore the data seem to indicate that in some pelagic fishes caught near natural Hg geochemical anomalies, the Hg levels are higher than in the same species caught in other zones.

On the other hand, sea-water and plankton organisms collected near mercury geochemical anomalies have about the same levels of mercury as in other zones. It is, therefore, evident that an explanation of the higher mercury concentration encountered in the above-mentioned marine species cannot be obtained on the basis of information of the Hg levels only. A model of the biogeochemical cycle of Hg may give an answer for the high Hg levels observed in the many marine organisms.

At the same time, it is known that selenium reduces significantly mercury toxicity. In humans and marine organisms correlations between Hg and Se levels have been observed, especially when the Hg levels were very high. For this reason the biogeochemical cycle of selenium should also be investigated.

A satisfactory resolution of this Hg problem is urgently needed since legislations, currently in force in some Mediterranean countries, consider marine foods with levels higher than 0.5 or 0.7 ppm (fresh weight) unfit for human consumption.

If these regulations were really enforced, a large part, if not all, of certain species of marine organisms (fish, shrimps, crabs, etc.) have to be withdrawn from the market, with the severe economic consequences for the fishery industry which already now struggles hard to survive.

- Review of available data on water, sediments and biota of Mediterranean Hg anomalies both in the adjacent coastal zone and in the hinterland.
- Identification of the major pathways from the sources to the coastal zone.
- Review of available data on anthropogenic sources of Hg with a discharge into the marine coastal zone and identification of the major pathways in the coastal zone and its terrestrial hinterland.
- Construction of a preliminary computer model of the principal compartments and fluxes between them and identification of insufficient or missing data.
- Determination of Se in the principal compartments and estimation of the fluxes between these compartments.
- Construction of a preliminary Se model.
- Improve the Hg and the Se models with the help of the new information available.

#### Outputs

1981-1983

- Review of the available data on Hg anomalies and anthropogenic sources.
- Hg model and Se model of a geochemical Hg anomaly.
- Preliminary impact assessment of marine Hg pathways from a natural geochemical anomaly and from significant anthropogenic sources.

1984-1990

- Complex models of the biogeochemical cycles of Hg and Se in areas with geochemical anomalies and in coastal areas with anthropogenic inputs.
- Assessment of the potential hazards arising from the consumption of marine foods with high Hg levels.

#### Workplan and timetable

<u>Activity</u>	<u>Timetable</u>	<u>Responsible</u>
- Designation of national institution	April 1981	National MED POL focal point in collaboration with FAO
- Assistance to the national centre participating in the project in terms of training and experts	June 1981- December 1983	FAO

- Meetings June 1981 June 1982 November 1983  
FAO in collaboration with national research centre
- Review of available data and identification of the major pathways July 1981-December 1981  
National research centre
- Construction of the preliminary Hg and Se models January 1982-December 1982  
National research centre
- Improvement of both models January 1983-October 1983  
National research centre
- Reporting and submission of proposal for future work December 1983  
National research centre in collaboration with FAO

Budget

(a) Contribution from MED Trust Fund

	1981	1982	1983	1984-1990
<u>1. Direct assistance to national institution</u>				
- Training	7,000	-	-	
- Experts	<del>8,000</del>	<del>17,000</del>	<del>18,000</del>	
- Material	4,000	2,000	1,000	
<u>2. Meetings</u>				
Initial meeting of participating experts (June 1981)	4,000	-	-	
Meeting for evaluation of preliminary results (June 1982)	-	4,000	-	
Meeting for evaluation of final report and to advise for future work (November 1983)	-	-	4,000	
3. Co-ordination costs (FAO)	are shown as separate budget			
4. Reporting costs	1,000	1,000	1,000	
5. Miscellaneous	1,000	1,000	1,000	
<b>Total</b>	<b>25,000</b>	<b>25,000</b>	<b>25,000</b>	<b>25,000</b>

(b) Contribution from the participating research centre

- Provision of laboratory space
- Operating costs of major equipment
- Personnel (including scientists and technicians)
- Other costs (secretarial assistance etc.)

PERSONNEL COMPONENT TIMETABLE

Year	1981												1982												1983												1984-1990											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30																		
Months	J	A	S	O	N	D	J	F	M	A	H	J	J	A	S	O	N	D	J	F	H	A	H	J	J	A	S	O	N	D																		
Months	congratulatory arrangement for a.1 and a.2																																															
Activities																																																
a.1																																																
a.2																																																
a.3																																																
Meetings																																																
Training																																																

congratulatory arrangement for a.1 and a.2

1/2 1/2  
2 w/m

Monitoring Programme

1st week meeting \*\*\*

4 days meeting

4 days meeting

4 days meeting

\*\*\* meeting of experts

\*\*\* meeting of experts

\*\*\* meeting of experts

\*\*\* meeting of experts

\*\*\* meeting of experts

\*\*\* meeting of experts



## 18. STUDY OF POLLUTANT-TRANSFER PROCESSES

18.1 RIVER INPUTS TO THE MEDITERRANEAN (see description under 5.1)

18.2 STUDIES ON TRANSFER OF POLLUTANTS THROUGH THE AIR-SEA INTERFACE (ref. paragraph 39m of UNEP/WG.46/4. Received from IAEA : 3 October 1980.

### Objectives

- (a) Long-term objectives: To identify quantitatively the sources of pollutants transported through the atmosphere into the Mediterranean Sea by investigating the amounts and transport mechanisms of these substances across the sea-air interface.
- (b) Short-term objectives: To acquire data on the atmospheric concentrations and the input flux across the sea-air interface of selected pollutants in various areas in the Mediterranean Sea. The data on the particulate/ gas transfer relationships of certain substances will also be collected.

### Background

There has been a long-standing question whether significant quantities of both natural and anthropogenic substances are transported to the mid-ocean regions via the atmosphere. This question is important in considering basic geochemical cycles and budget of a variety of naturally occurring substances as well as in predicting the global impact of anthropogenic materials on the oceanic geochemical processes. The evidence to date shows that potentially significant quantities of lead and other metals, DDT, PCB, low molecular weight petroleum hydrocarbons, etc. are transported to open ocean regions through the atmosphere, either as particles or in the gas phase. For example, the high lead content of Greenland ice in recent year has been attributed to the burning of tetraethyl lead in automobile fuel in the highly populated areas of the northern hemisphere. Although the atmospheric concentrations of various substances have been determined in the Pacific and Atlantic, such determinations have scarcely been carried out in the Mediterranean. In addition, the rates of exchange of these substances between the ocean atmosphere and sea are still largely unknown. Since the Mediterranean Sea is a semi-closed sea, the effects of the atmospheric transport of pollutants are expected to be more elevated than other open ocean regions. Thus the understanding and assessment of the atmospheric transport of pollutants are essential to evaluate the overall pollution situation in the Mediterranean Sea.

### Activities

The marine aerosol samples will be collected extensively by the bow-tower sampling systems during several cruises in various areas in the Mediterranean Sea, which are expected to be organized in relation to the long-term monitoring programme for the reference areas in the Mediterranean Sea. Surface film sampling with appropriate systems such as "Caret Screen", etc. will also be performed. The samples will be analysed for metals (Fe, Cu, Zn, Cd, Hg, Pb, etc.), selected chlorinated and petroleum hydrocarbons, etc. For the metal analysis flameless atomic absorption spectrophotometry and instrumental neutron activation analysis will be applied. The structure of aerosol particles will be examined by scanning electron microscope and electron microprobe in order to distinguish the metal fraction originating from natural sources from that coming from anthropogenic sources. On the basis of these measurements, the investigations of the exchange flux of the pollutants between the marine atmosphere and sea through the air-sea interface will be conducted. The relationship between the particulate and gas phases in the exchange processes will also be examined. The comparisons of the data with those obtained in the Atlantic and Pacific are expected to provide a better understanding of pollution processes going on in the Mediterranean Sea, which is under the combined influence of three major sources of aerosols: highly industrialized northern sector, wind weathering from desert areas in the southern sector, and volcanic activities (Etna, Stromboli, etc.). The work proposed will be performed at the ~~CNRS/CEA Centre des Faibles Radioactivites~~ Centre des Faibles Radioactivites, France, under subcontract through the IAEA's International Laboratory of Marine Radioactivity with appropriate collaboration of other laboratories in the region.

### Output

The progress and results of these studies will be presented at the relevant scientific meetings and in publications. The general quantitative picture of the atmospheric transport of pollutants from major sources and their fluxes into the Mediterranean Sea will be deduced.

### Workplan and timetable

Collections of aerosol samples, gas samples and surface film samples	May 1981 - September 1983 (whenever shiptime is available)
Analysis of samples	July 1981 - December 1983
Data analysis	November 1981 - September 1983
Preparation of report	October - December 1983

Budget (1981-1983)

	UNEP			Contribution of engaged laboratory (1981 - 1983)
	1981	1982	1983	
<b>10. Project Personnel</b>				
11/12. Experts/consultants	15,000	25,000	25,000	75,000
16 Travel	2,000	3,000	3,000	6,000
<b>40. Equipment</b>				
41. Expendable equipment	2,500	3,000	3,000	6,000
42. Non-expendable equipment	5,000	2,000	2,000	9,000
<b>50. Miscellaneous</b>				
51. Operation and maintenance of equipment	1,000	1,000	1,000	21,000
52. Reporting costs	-	500	1,000	-
53. Sundry	500	500	1,000	3,000
<b>Total</b>	<b>26,000</b>	<b>35,000</b>	<b>36,000</b>	<b>120,000</b>

## 19. SUPPORTING ACTIVITIES

19.1 EMERGENCY AND MAINTENANCE SERVICES FOR SCIENTIFIC INSTRUMENTS BEING USED IN THE MED POL - PHASE II (ref. paragraphs 15-26 and 40-45 of UNEP/WG.46/4). Received from IAEA : 15 September 1980.

### Objectives

- (a) Long-term objectives: to ensure the continuing operation of measurement instruments distributed to the research centres taking part in the long-term monitoring programme of Mediterranean pollution and to give technical advice to instrument operators to assist them in obtaining a high level of analytical performance.
- (b) Short-term objectives: to provide emergency and maintenance services to achieve the above objectives by the provision of a qualified electronics engineer located in the region.

### Background

During MED POL - PHASE I the instrument maintenance and emergency services to the various research centres which received instruments through UNEP funding were provided by an electronics engineer who was based at the International Laboratory of Marine Radioactivity at Monaco. This mechanism worked quite effectively, and the services rendered received general appreciation from many research centres, especially those located in the eastern and southern parts of the Mediterranean region. This operation was considered to be one of the key factors which resulted in the substantial development of the measuring capability in the Mediterranean region.

Since the same instrument used for MED POL - PHASE I projects will be used in the long-term monitoring programme (MED POL - PHASE II), and since the instrument manufacturers have not fully developed their services in the eastern and southern part of the Mediterranean region as yet, it is considered essential for the smooth operation of the Phase II projects to continue the emergency and maintenance service mechanism established already for the Phase I projects.

### Activities

For the emergency repair and regular checking of the measurement instruments already distributed to the Mediterranean research centres as well as for any new installations and initial checking of such instruments which will be distributed in the future, an electronics engineer responsible for these works will be stationed at Monaco and made available

to all research centres engaged in the MED POL - PHASE II projects. On request from the research centres, the electronics engineer will be despatched from Monaco with a minimum delay to solve the instrument problems on the spot. The expenses involved in these operations are mainly the salary for the engineer, his travel and spare parts for the various instruments located in the region.

Output

The research centres in the region receive an immediate emergency maintenance service which allows them to continue the execution of their Phase II projects. The operators of the instruments receive appropriate technical advice on the upkeep of the instruments so as to achieve good analytical performance. The results of the service visits are reported regularly to the Contracting Party Meetings.

Workplan and timetable

Hiring of the electronics engineer	April 1981
Emergency and maintenance services of the engineer	Continuous 1981-1983
Presentation of a progress report at the Contracting Party Meeting	March 1983

Budget (1981-1983)

	UNEP			IAEA contribution (1981-1983)
	1981	1982	1983	
<b>10. Project Personnel</b>				
11/12 Experts/Consultants	52,000	54,000	56,000	3,000
13. Admin. support	3,000	3,000	3,000	9,000
16. Travel	10,000	11,000	12,000	3,000
<b>40. Equipment</b>				
41. Expendable equipment	10,000	10,000	10,000	6,000
42. Non-expendable equipment	6,000	5,000	5,000	-
<b>50. Miscellaneous</b>				
51. Operation and maintenance of equipment	2,500	2,500	2,500	6,000
52. Reporting costs	-	-	1,000	6,000
53. Sundry	1,500	1,500	1,500	3,000
<b>GRAND TOTAL</b>	<b>85,000</b>	<b>87,000</b>	<b>89,000</b>	<b>36,000</b>

19.2 INTERCALIBRATION OF POLLUTANT MEASUREMENTS (ref. paragraphs 15-26, 31 and 40-45 of UNEP/WG.46/4). Received from IAEA : 15 September 1980.

### Objectives

- (a) Long-term objectives: to ensure the comparability of the results produced by the institutions participating in the monitoring operations in MED POL - PHASE II - particularly for the measurements of heavy metals, chlorinated hydrocarbons and petroleum hydrocarbons.
- (b) Short-term objectives (1983): to organize and co-ordinate intercalibration exercises for heavy metal, chlorinated hydrocarbon and petroleum hydrocarbon measurements with the institutions participating in the MED POL - PHASE II by preparing and distributing appropriate samples, collecting the analytical results and evaluating the analytical performance of the participating institutions.

### Background

During MED POL - PHASE I, participating in the intercalibration exercises for the trace metal and chlorinated hydrocarbon measurements was considered mandatory for the institutions taking part in MED II and MED III projects. Four intercalibration exercises were organized for each type of pollutant. The results of these intercalibration operations proved that the analytical performance of the Mediterranean research centres was generally satisfactory and that the comparability of the measurements improved with the repetition of the exercises. In order to maintain the high standards of analytical performance achieved within the Mediterranean region and to ensure that sound conclusions are based on excellent scientific data, the participation of the intercalibration exercises within the framework of MED POL - PHASE II, is considered to be a prerequisite for all participating institutions.

### Execution of the intercalibration programme

In addition to the intercalibration exercises for heavy metal and chlorinated hydrocarbon measurements, it is proposed that similar work for petroleum hydrocarbon measurements be initiated in MED POL - PHASE II. For each type of pollutant four intercalibration samples (two biological samples + two sediment samples) will be distributed to the participating research centres during the period 1981-1983. The analytical results will be collected, compiled and evaluated by statistical tests and feedback to the research centres which will have participated in the programme. When the laboratories experience difficulties in maintaining good analytical performance, technical advice and assistance will be provided.

### Output

The overall results of the intercalibration exercises will be fed back to the participating research centres in the form of progress reports, which will be issued at appropriate intervals. The overall evaluation of analytical performance of the participating Mediterranean research centres will be presented to the meeting of the contracting parties.

Workplan and timetable

Preparation of intercalibration material (1 biological sample + 1 sediment sample, including homogeneity tests)	June - November 1981
First series of intercalibration exercises	December 1981 - March 1982
Preparation of intercalibration material (1 sediment sample)	January - April 1982
Second series of intercalibration material (1 biological sample)	May - September 1982
Preparation of intercalibration material (1 biological sample)	January - April 1983
Presentation of the progress on the intercalibration programme at the contracting party meeting	March 1983
Third series of intercalibration exercises	May - September 1983
Preparation of final report	October - December 1983

Budget (1981-1983)

	UNEP			IAEA contribution (1981-1983)
	1981	1982	1983	
10. Project Personnel				
11/12 Experts/Consultants	8,000	4,000	4,000	56,000
13. Admin. support	2,000	2,000	2,000	7,000
16. Travel	3,000	2,000	2,000	3,000
40. Equipment				
41. Expendable equipment	15,000	8,000	8,000	15,000
42. Non-expendable equipment	10,000	5,000	5,000	-
50. Miscellaneous				
51. Operation and maintenance of equipment	3,000	3,000	3,000	5,000
52. Reporting costs	-	500	1,000	3,000
53. Sundry	3,000	2,500	2,000	3,000
<b>GRAND TOTAL</b>	<b>45,000</b>	<b>27,000</b>	<b>27,000</b>	<b>92,000</b>

19.3 QUALITY CONTROL PROGRAMME (ref. paragraph 31 of UNEP/WG.46/4).  
Received from WHO : 7 October 1980.

### Objectives

The long-term objectives of the proposed project are those described for the long-term programme for the Pollution Monitoring and Research in the Mediterranean (MED POL - Phase II) (document UNEP/WG.46/4).

The specific objectives are as follows:

- To assess the laboratory performance and efficiency of the participating national laboratories in the long-term programme.
- To harmonize practices and promote accuracy and comparability of data.
- To develop a manual for laboratory quality control.

### Background

The pilot phase of the Co-ordinated Mediterranean Pollution Monitoring And Research Programme (MED POL Phase I) includes among the initial seven pilot projects (MED POL I to VII) one dealing with Coastal Water Quality Control in the Mediterranean (MED VII).

In the immediate objectives of this project, the following is included:

"To design and implement a programme for sanitary and health surveillance of coastal recreational areas and shellfish growing waters in selected coastal areas of the Mediterranean".

Following this objective a monitoring programme of selected coastal areas has been established and is being implemented.

In carrying out the relevant microbiological indicators monitoring programme of work and comparing the results obtained by the collaborating national laboratories the need becomes apparent not only to use standard procedures but to also introduce a quality control programme for each collaborating laboratory.

The development of such a programme will promote the production of reliable data and comparability of results.

The present project is intended to plan, develop and carry out a programme on laboratory quality control.

### Proposed activities

(a) For the period 1981-1983

1. Necessary measures will be initiated in order to assure in each collaborating a good control of the general working conditions that can induce errors in the final analysis results.



For this purpose each collaborating laboratory will undertake media and equipment control methods.

In this respect general rules will be established and their application checked.

2. An intra-laboratory quality control will be carried out as a first stage of the quality control programme.

This will include two steps:

- multiple analyses performed by different analysts.
- multiple colony counts performed by different analysts.

The multiple analyses will be carried out with the same methodology and following prescribed procedures. Results will be reported on special forms and results of different analysts will be compared by a t-test.

The above exercise will be carried out every six months at the least.

The second step, the "Multiple colony countings", will consist of multiple colony countings of individual plates for each bacterial parameter, fixed as mandatory, and performed by different analysts. The number of plates, the methodology applied, and the nutrients used will follow agreed directives.

the colonies counting and their reporting will take place as prescribed. Evaluation of results and comparison will be undertaken with the t-test.

This exercise will be carried out at least twice a year.

The results of (i) and (ii) will be gathered and reported annually.

An inter-laboratory quality control will be carried out as a second stage of the quality control programme.

This stage will be carried out in two phases.

Phase I: During the first phase, bacterial suspension prepared by each Collaborating Laboratory on the basis of the bacterial strains sent by a selected Mediterranean Central Laboratory, will be analysed. The Central Laboratory is expected to carry out the centralized tasks provided by the Quality Control Programme.

Phase II: In the second phase, samples with unknown bacterial suspension will be sent directly by the above Central Laboratory to the collaborating laboratories for their analysis.

Details of the procedures for the first and second phases will be provided. Results will be reported on special forms and sent to the Central Laboratory for further evaluation.

The inter-laboratory Quality Control will be carried out at least every six months.

4. Comparison and analysis of results as well as reporting will be prepared by the Central Laboratory.

The co-ordination and follow-up of the proposed activities 1, 2, 3 and 4 will be carried out by the selected National Institute. The details of the work to be undertaken and the relevant remuneration of the selected National Institute will be established through a contractual agreement. All of the collaborating National Laboratories are expected to participate in the proposed activities and undertake their relevant part.

5. Meetings

Annual consultation between national scientists responsible for carrying out the national components of the project are being proposed. They are intended

- to stimulate participation
- to ensure harmonization of inputs
- to review and agree upon appropriate measures
- to evaluate results and plan for the future

These annual meetings are intended also to cover the needs of other interrelated projects within the long-term programme. Similarly, other meetings of the same nature planned in the long-term programme may cover the above objectives. In these cases appropriate arrangements will be made in order to avoid unnecessary duplication.

6. Technical assistance

A limited amount of equipment especially expendable material is intended to be provided to some of the Collaborating National Laboratories according to existing needs. This provision will further promote the standardization of procedures and methodology.

- (b) For the period of 1984-1990

1. Continuation of the proposed activities and improvement of procedures and methodology.

Development of a manual for laboratory quality control.

Output

(a) For the period of 1981-1983

1. Development of a draft manual for laboratory quality control
2. Improvement in the accuracy and comparability of microbiological analysis.

(b) For the period of 1984-1990

1. Development of a manual for laboratory quality control.

Workplan and timetable

Activities

Starting and ending  
(from month 0)

a.1 through a.4

Twice a year at equal intervals for each collaborating Laboratory. Starting date to be established individually for each Collaborating Laboratory with the aim to have a balanced distribution of work.

Meetings

5	4 days duration
17	4 days duration
29	4 days duration

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Tentative Budget (in US dollars)

	1981	1982	1983	1984-1990
Experts	3,000			
Sub-contract	15,000	25,000	25,000	
Equipment	10,000	10,000	10,000	
Training	-	-	-	
Direct assistance	31,000	35,000	35,000	
Meetings*	4,000	4,000	4,000	
Co-ordination costs	4,000	4,000	4,000	
Reporting costs	2,000	2,000	2,000	
Miscellaneous	1,000	1,000	1,000	
Total	29,000	46,000	46,000	35,000 (per year)

\*It is proposed to organize an annual meeting for stimulating, reviewing, evaluating and adjusting work undertaken by related projects. The estimated cost (\$4,000) per year represents the share of the present project to the total cost of these meetings.