



UNEP

**MEDITERRANEAN ACTION PLAN
MED POL**

UNITED NATIONS ENVIRONMENT PROGRAMME



WORLD HEALTH ORGANIZATION

**SURVEY OF POLLUTANTS FROM LAND-BASED SOURCES
IN THE MEDITERRANEAN**

**EVALUATION DE L'ENQUETE SUR LES POLLUANTS
D'ORIGINE TELLURIQUE EN MEDITERRANEE
(MED X BIS)**

MAP Technical Reports Series No. 109

Note: The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of UNEP or WHO concerning the legal status of any State, Territory, city or area, or of its authorities, or concerning the delimitation of their frontiers or boundaries.

The first version of this document was prepared by Mr Ante Baric of the Institute of Oceanography and Fisheries, Split with the assistance of Dr Louis Saliba. The overall technical responsibility was entrusted to WHO (Responsible Officer: Dr G. Kamizoulis).

Note: Les appellations employées dans ce document et la présentation des données qui y figurent n'impliquent de la part du PNUE ou de l'OMS aucune prise de position quant au statut juridique des états, territoires, villes ou zones, ou de leurs autorités, ni quant au tracé de leurs frontières ou limites.

La première version du document a été préparée par M. Ante Baric (Institut d'océanographie et de pêche, Split) en collaboration avec Dr Louis Saliba. L'OMS a été chargée de la responsabilité technique de l'ouvrage (Responsable pour l'OMS: Dr G. Kamizoulis).

© 1996 United Nations Environment Programme
P.O. Box 18019, Athens, Greece

ISBN 92-807-1616-6

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source.

No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from UNEP.

For bibliographic purposes this volume may be cited as:

UNEP/WHO: Survey of pollutants from land-based sources in the Mediterranean Sea. MAP Technical Reports Series No. 109 UNEP, Athens, 1996.

Pour des fins bibliographiques, citer le présent volume comme suit:

PNUE/OMS: Evaluation de l'enquête sur les polluants d'origine tellurique en Méditerranée (MED X BIS). MAP Technical Reports Series No. 109 UNEP, Athens, 1996.

This volume is the one hundred and ninth of the Mediterranean Action Plan Technical Reports Series.

This series will collect and disseminate selected scientific reports obtained through the implementation of the various MAP components: Pollution Monitoring and Research Programme (MED POL), Blue Plan, Priority Actions Programme, Specially Protected Areas, Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea, Environment Remote Sensing and Protection of Historic Sites.

Ce volume constitue le cent neuvième de la série des Rapports techniques du Plan d'action pour la Méditerranée.

Cette série permettra de rassembler et de diffuser certains des rapports scientifiques établis dans le cadre de la mise en oeuvre des diverses composantes du PAM: Programme de surveillance continue et de recherche en matière de pollution (MED POL), Plan Bleu, Programme d'actions prioritaires, Aires spécialement protégées, Centre régional méditerranéen pour l'intervention d'urgence contre la pollution marine accidentelle, Centre méditerranéen de télédétection et Protection des sites historiques.

**SURVEY OF POLLUTANTS FROM LAND-BASED SOURCES
IN THE MEDITERRANEAN**

TABLE OF CONTENTS

	Page
1. Introduction and background	1
2. The first survey on pollutants from land-based sources in the Mediterranean (MED X)	6
3. Organization of the current survey	13
4. Interim results of the current survey	17
4.1. Municipal wastewater production and collection	17
4.2. Municipal wastewater treatment	22
4.3. Municipal wastewater and sludge disposal	25
4.4. Municipal wastewater re-use	28
4.5. Municipal solid wastes	29
4.6. Industrial wastewater	29
5. Situation analysis	34
6. Conclusions and recommendations	36
Annex 1. Questionnaires utilized in the current survey.	37

1. INTRODUCTION AND BACKGROUND

1.1. Serious concern about the state of pollution of the Mediterranean Sea, mainly as a result of largely-uncontrolled discharges of municipal and industrial effluents, reached its climax in the early 1970s. Following a series of intergovernmental meetings between 1971 and 1974, the United Nations Environment Programme (UNEP) convened an intergovernmental meeting on the protection of the Mediterranean Sea in Barcelona from 28 January to 4 February 1975. During this meeting, the governments of the coastal states of the region adopted the Mediterranean Action Plan, which was the first programme aimed at the prevention and control of marine pollution on a region-wide basis, and also provided a model for similar activities in other areas of the world within the framework of UNEP's Regional Seas programme.

The Mediterranean Action Plan

1.2. As adopted by the governments of the region in 1975, the Mediterranean Action Plan consisted of four basic components:

- (a) Integrated planning of the development and management of the resources of the Mediterranean basin (Blue Plan and Priority Actions Programme);
- (b) A coordinated programme of research, monitoring and exchange of information, and for assessment of the state of pollution and of pollution measures (MED POL Programme);
- (c) A framework convention and related protocols with their technical annexes for the protection of the Mediterranean environment;
- (d) Institutional and financial implications of the Action Plan.

1.3. The legal framework for the cooperative regional programme was adopted in the Final Act of the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region for the Protection of the Mediterranean Sea, convened by UNEP in Barcelona from 2 to 16 February 1976. In particular, the Conference adopted, and government representatives signed, the Convention for the Protection of the Mediterranean Sea against Pollution and two Protocols, dealing respectively with dumping at sea and cooperation in cases of pollution emergencies. A further three protocols, dealing with land-based sources of pollution, specially-protected areas, and seabed exploration and exploitation, were adopted and signed in 1980, 1982 and 1994 respectively. A further protocol, dealing with pollution by hazardous substances, is currently under negotiation.

1.4. The 1976 Convention, the 1976 Dumping Protocol, and the 1982 Specially-protected Areas Protocol were amended by the Ninth Ordinary Meeting of the Contracting Parties, held in Barcelona from 5 to 8 June 1995, and the instruments, as amended, were formally adopted and signed during a Conference of Plenipotentiaries convened by UNEP in Barcelona from 9 to 10 June 1995. Following two meetings of legal and technical experts, amendments to the 1980 Land-based Sources Protocol were formally adopted and signed during a Conference of Plenipotentiaries convened by UNEP in Syracuse from 6 to 7 March 1996, the new title of the Protocol becoming "Protocol for the Protection of the Mediterranean Sea against Pollution from

Land-based Sources and Activities". The respective amendments to all these legal instruments are expected to come into force shortly.

1.5. The integrated planning (now termed environmental management) component was aimed at the development of programmes of activities, including the amplification of those already in progress, on (1) the development and application of rational techniques from the points of view of economy, ecology and health in various fields such as treatment, use and safe disposal of organic and industrial wastes, restoration of degraded natural communities, use and recycling of fresh water and improvement and better utilization of the resources of the sea, in particular by aquaculture, (2) the study of the costs and of the economic and social advantages of taking environmental factors into consideration in development projects, on the basis of environmental impact assessments, (3) the study of the repercussions of economic development, particularly of the development of tourism and industry, on the environment of the region, and (4) the study of a system of vocational training at all levels.

1.6. This component was originally envisaged to cover the "Blue Plan", a prospective multisectorial study linking socio-economic development with environmental preservation. In view of the need for immediate practical action on the basis of already-existing knowledge, a second sub-component, the Priority Actions Programme was added to cover sub-regional projects in the fields of water resource management, aquaculture, renewable sources of energy, human settlements, tourism and soil conservation.

The MED POL Programme

1.7. The pilot phase of the Coordinated Mediterranean Pollution Monitoring and Research Programme (MED POL Phase I) was developed by UNEP and a number of UN Specialized Agencies (mainly FAO, WHO, UNESCO, IOC, WMO and IAEA) in 1974 and adopted by Mediterranean governments in 1975. Initially, it consisted of seven pilot projects (MED I to MED VII), each dealing with a different aspect of marine pollution monitoring or research, but was later expanded to include another six (MED VIII to MED XIII). The latter included a survey of pollutants from land-based sources in the Mediterranean (MED X).

1.8. The first phase of the MED POL Programme was completed in 1980, and a second phase, the Long-term Programme of Monitoring and Research in the Mediterranean Sea (MED POL Phase II), was approved by the governments of the region in their capacity of Contracting Parties to the 1976 Barcelona Convention and Protocols at their Second Ordinary Meeting, held in Cannes from 2 to 7 March 1981.

1.9. Originally designed to cover the period 1981-1990, the MED POL Phase II programme was extended up to the end of 1996. Its general objective was to further the goals of the 1976 Barcelona Convention by assisting the Parties to prevent, abate and combat pollution of the Mediterranean Sea area, and to protect and enhance the marine environment of the area. The specific objectives were designed to provide, on a continuous basis, the Parties to the Barcelona Convention and its related protocols with:

- (a) Information required for the implementation of the Convention and protocols;
- (b) Indicators and evaluation of the effectiveness of the pollution prevention measures taken under the Convention and the protocols;

- (c) Scientific information possibly leading to eventual revisions and amendments of the relevant provisions of the Convention and the protocols, and for the formulation of additional protocols;
- (d) Information which could be used in formulating environmentally-sound national, bilateral and multilateral management decisions essential for the continuous socio-economic development of the Mediterranean on a sustainable basis;
- (e) Periodic assessment of the state of pollution of the Mediterranean Sea.

1.10. A new phase of MED POL, designed to cover the period 1996-2005, was approved by the Contracting Parties during an Extraordinary Meeting, held in Montpellier from 1-4 July 1996. The main goal of this phase of MED POL shall be to serve the Contracting Parties to the Barcelona Convention and Protocols as their long-term programme for the assessment, prevention, mitigation and control of pollution in the geographic area covered by the Convention and the Mediterranean Action Plan. This goal shall be achieved by:

- (a) Assessing all sources of pollution, the load of pollution reaching the Mediterranean Sea, and the magnitude of the problems caused by the impact of pollutants on living and non-living resources, including human health, as well as on amenities and uses of the marine and coastal regions;
- (b) Formulating measures for prevention and control of pollution, and measures for mitigation of impacts caused by pollution, including measures for the restoration of systems already damaged by pollution;
- (c) Monitoring the effectiveness of the implementation of the pollution prevention, mitigation and control measures adopted;
- (d) Assessing the trends in the quality of the marine and coastal environment attributable to pollution in particular, and acting as an early warning system for potential environmental problems caused by pollution.

Land-based pollution

1.11. Under the terms of Article 8 of the original Convention, Contracting Parties pledged themselves to take all appropriate measures to prevent, abate, and combat the pollution of the Mediterranean Sea area. The amended Convention specifies that the Contracting Parties, besides the above mentioned, shall take measures to eliminate pollution to the fullest possible extent, and to draw up and implement plans for the reduction and phasing out of substances that are toxic, persistent and liable to bioaccumulate arising from land-based sources. The same article in the revised version of the Convention amplifies on this by also specifying pollutant pathways.

1.12. At the time of adoption of the Barcelona Convention in 1976, it was estimated that more than 80% of the pollution load of the Mediterranean Sea originated from sources on land, mainly in the form of still largely-uncontrolled discharges of municipal and industrial wastes is reaching the sea both directly from coastal sources and indirectly through rivers. In view of this fact, particular attention was devoted to the preparation of an appropriate legal instrument to cover this aspect of pollution. Following a number of expert consultations held between 1977 and 1979, the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-based Sources was adopted and signed by a Conference of Plenipotentiaries held in Athens from 12

to 17 May 1980. The first survey of pollutants from land-based sources in the Mediterranean (MED X) was added to the initial list of MED POL Phase I pilot projects with the aim of providing documentary evidence of the state of land-based pollution of the Mediterranean Sea as one of the technical inputs into the preparatory stages of the protocol.

1.13. The protocol entered into force in June 1983. Following this, the technical preparations for its progressive implementation were carried out by the Mediterranean Action Plan Secretariat in collaboration with the relevant UN Specialized Agencies within the general framework of MED POL Phase II, to which a new component - activities in connection with the land-based sources protocol - was added. A meeting of experts on the technical implementation of the protocol was convened by UNEP in Athens from 9 to 13 December 1985. The meeting approved a calendar of activities covering the period 1985 to 1995. These activities mainly consisted in (a) the preparation of assessments of the state of pollution of the Mediterranean Sea by individual substances listed in Annexes I and II to the protocol, including proposed prevention and control measures for submission to, and adoption by, the Contracting Parties, and (b) the development of guidelines on various aspects of waste management covered by the protocol. They also included the preparation and implementation of a new survey on land-based pollutants in the Mediterranean, aimed at updating the information contained in the 1976-1977 survey, and identifying any trends over the past decade as a result of prevention and control measures developed during this period.

1.14. In the new version of the Protocol, the original Annexes I and II have been combined into one annex, in which the original lists of substances remain practically the same. The annex also includes a list of land-based activities likely to result in pollution of the sea.

1.15. On the basis of assessments of the state of pollution of the Mediterranean Sea by individual substances, a number of measures were adopted by Contracting Parties as part of the progressive implementation of the land-based sources protocol. These measures, adopted at successive Ordinary meetings of the Contracting Parties since 1985, are the following:

- (a) Interim environmental quality criteria for bathing waters (1985);
- (b) Interim environmental quality criteria for mercury (1985);
- (c) Measures to prevent mercury pollution (1987);
- (d) Environmental quality criteria for shellfish waters (1987);
- (e) Measures for control of pollution by used lubricating oils (1989);
- (f) Measures for control of pollution by cadmium and cadmium compounds (1989);
- (g) Measures for control of pollution by organotin compounds (1989);
- (h) Measures for control of pollution by organohalogen compounds (1989);
- (i) Measures for control of pollution by organophosphorus compounds (1991);

- (j) Measures for control of pollution by persistent synthetic materials (1991);
- (k) Measures for control of radioactive pollution (1991);
- (l) Measures for control of pollution by pathogenic microorganisms (1991);
- (m) Measures for control of pollution by carcinogenic, teratogenic and mutagenic substances (1993);
- (n) Measures for the control of pollution by zinc, copper and their compounds (1996);
- (o) Measures for the control of pollution by detergents (1996).

The Genoa Declaration

1.16. During the Fourth Ordinary Meeting of the Contracting Parties to the Barcelona Convention and Protocols in Genoa in September 1985, Mediterranean States adopted a formal Declaration (subsequently termed the Genoa Declaration) wherein they committed themselves to the achievement of a number of environmental targets during the second decade of operation (1986-1995) of the Mediterranean Action Plan. These targets included the establishment as a matter of priority of sewage treatment plants in all cities around the Mediterranean with more than 100,000 inhabitants, and appropriate outfalls and/or appropriate treatment plants for all towns with more than 10,000 inhabitants. This target has only been partially achieved, but the general situation has improved considerably in a number of Mediterranean areas through the establishment of new sewage treatment plants and the construction of submarine outfall structures, as a result of which a certain proportion of wastewater is no longer being discharged in the immediate coastal zone, *i.e.* practically at the land/sea interface.

Scope of the interim report

1.17. The second survey on pollutants from land-based sources in the Mediterranean commenced in mid-1989, and is still operational in the sense that most of the completed questionnaires received provided only partial information. In addition, no replies have been received so far from some countries. Progress in the implementation of the survey was discussed at an *ad hoc* Consultation on evaluation of the results of the survey of pollutants from land-based sources in the Mediterranean (MED X BIS), jointly convened by UNEP and WHO in Athens from 5 to 6 December 1995, which meeting also agreed on the format and content of the present document. The scope of this interim report, which reflects the situation as prevailing at the end of November 1995, and which has been prepared with the assistance of two consultants (Dr A. Baric, Croatia; and Dr L.J. Saliba, Malta) is to consolidate and analyse results obtained so far, to attempt to compare these results with any corresponding ones from the first survey, as well as to correlate them to the extent possible with prevention and control measures taken, and to make appropriate recommendations regarding the completion of the survey.

2. THE FIRST SURVEY ON POLLUTANTS FROM LAND-BASED SOURCES IN THE MEDITERRANEAN (MED X)

Scope and purpose

2.1. The main objective of the 1976-1977 survey (MED X) was to provide the governments of the states bordering the Mediterranean with appropriate information on the type and quantity of pollution loads arising from the major land-based sources and carried by rivers, and on the current status of waste disposal and management practices. In order to achieve a comprehensive picture of all major pollutants entering the Mediterranean Sea from land-based sources, the following tasks were to be undertaken:

- (a) Preparation of an inventory of all major sources of pollutants in the coastal area;
- (b) Assessment of the nature and quantity of selected pollutants entering the Mediterranean from such sources;
- (c) Assessment of the nature and quantity of selected pollutants entering the Mediterranean by major rivers;
- (d) Review of current waste disposal and management practices.

2.2. The time-schedule for the project was closely linked to the preparation and negotiation of the draft protocol on land-based pollution sources, which entered its critical phase in the Autumn of 1977. Consequently, the time available for implementation of the project was limited to one and a half years, which only allowed for an overall assessment of relevant pollution sources. It was expected that more detailed pollution source inventories would be established as a follow-up to the project and as a means to implement the protocol.

Mode of implementation

2.3. The unprecedented task of compiling a waste source inventory over a large geographical area involving the collaboration of eighteen individual countries required the development of new approaches. In addition, the different nature of pollution sources considered made harmonization of methods a prerequisite to any data collection effort at the country level. In view of the complex nature of the problem, a two-step approach was selected, which allowed for an intermediate adjustment of interpretation methods. In a first phase, sectorial inventories were established, which were intended to register all activities in the coastal area of the Mediterranean which might involve the discharge of wastewaters. In a second phase, this inventory, together with other information, was used to assess and quantify the pollution input from the various sources. Harmonization of approaches to the different waste source categories was achieved primarily through the establishment of a common list of selected pollutants. On the basis of this list, a set of questionnaires which provided for a comparable data collection format was prepared. The questionnaires in draft form were circulated to interested countries, following which they were finalized and distributed.

2.4. The questionnaires used were the following:

- (a) Municipal waste disposal from coastal metropolitan or urban areas with a population of 10,000 and above;
- (b) Waste disposal from coastal tourist development in coastal areas;
- (c) Waste disposal and management at country level;
- (d) Industrial wastes, waste disposal and management;
- (e) Measurements of nutrients removed from agricultural land, and calculation of soil loss;
- (f) Land use, farm animals, and fertilizer use;
- (g) Use of pesticides in agriculture;
- (h) Inventory of major rivers;
- (i) Particulate pollutants sampling and analysis;
- (j) Radioactive discharges to the Mediterranean Sea from land-based sources.

2.5. The assessment of pollution loads was made for each pollutant individually. To this end, the major contributing sources had to be identified by category. The pollutants considered in each source category and those for which a total input budget was computed are shown in Table 2.1. Insignificant contributions or uncertainty of estimate reduced the range of sources considered in most cases. The geographical distribution of pollution loads was evaluated on the basis of ten regional entities into which the Mediterranean Sea was subdivided. A list of these areas and the countries bordering on them is shown in Table 2.2, while their extent and boundaries are shown in Figure 1.1.

Results and conclusions

2.6. The assessment of the pollution loads discharging into the Mediterranean from different waste sources was undertaken largely on the basis of an indirect estimate which took into account original country survey data, as well as statistical information and other data sources. The estimated annual loads, presented in an overall form in Table 2.3, were considered as accurate within an error range of one degree of magnitude.

2.7. A review of waste disposal and management practices was undertaken on the basis of the relevant questionnaires. Additional information was available from international reviews, project reports, national statistics, and data collected during consultant visits.

Table 2.1

Pollutants and waste sources considered in the estimate of annual pollution loads in the Mediterranean from land-based sources

	Pollution loads originating in the coastal zone			Loads carried by river discharges	Total load
	Domestic sewage	Industrial wastewater	Agricultural run-off		
1. <u>Volume:</u>					
Total discharge	+	+	+	+	+
2. <u>Organic matter:</u>					
BOD	+	+	+	+	+
COD	+	+	+	+	+
TOC	-	-	+	-	-
3. <u>Nutrients:</u>					
Phosphorus	+	+	+	+	+
Nitrogen	+	+	+	+	+
4. <u>Specific organics:</u>					
Detergents	+	-	-	+	+
Phenols	-	+	-	+	+
Mineral oil	-	+	-	-	+
5. <u>Metals:</u>					
Mercury	+	+	-	+	+
Lead	+	+	-	+	+
Chromium	+	+	-	+	+
Zinc	+	+	-	+	+
6. <u>Suspended matter:</u>					
TSS	+	+	+	+	+
VSS	+	-	-	-	-
7. <u>Pesticides:</u>					
Organochlorine compounds	-	-	+	+	+
8. <u>Radioactivity:</u>					
Tritium	-	+	-	+	+
Other radionuclides	-	+	-	+	+

Legend: “+” pollutant contributions from this source category are included in the pollution load assessment

“-” pollutant contributions from this source are disregarded due to insignificance or uncertainty of estimate.

Table 2.2

Regional entities of the Mediterranean Sea and countries bordering on them
(Pollutants from land-based sources in the Mediterranean, UNEP Regional Seas Reports and Studies No. 32, 1984)

A. Mediterranean proper		
	Regional sea	Bordering countries
I	Alboran	Spain, Morocco, Algeria
II	North-Western	Spain, France, Monaco, Italy
III	South-Western	Spain, Italy, Algeria, Tunisia
IV	Tyrrhenian	Italy, France, Tunisia
V	Adriatic	Italy, Yugoslavia, Albania
VI	Ionian	Italy, Albania, Greece
VII	Central	Italy, Tunisia, Libya, Malta
VIII	Aegean	Greece, Turkey
IX	North-Levantin	Turkey, Cyprus, Syria, Lebanon
X	South-Levantin	Lebanon, Israel, Egypt, Libya
B. Adjacent areas		
	Regional sea	Bordering countries
XI	Atlantic	Spain, Morocco
XII	Sea of Marmara	Turkey
XIII	Black Sea	Turkey, USSR, Rumania, Bulgaria

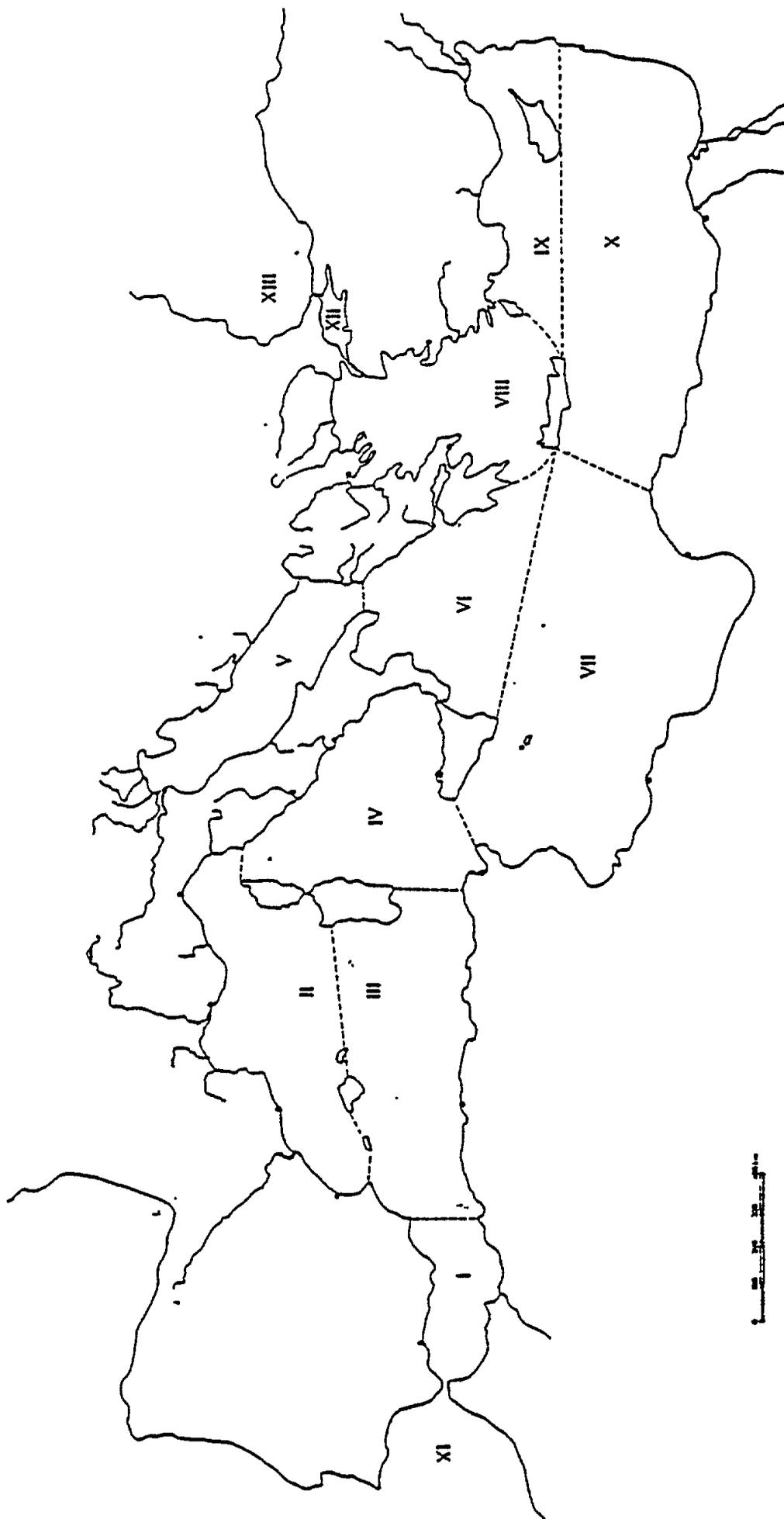


Figure 2.1

Regional entities of the Mediterranean proper and adjacent sea areas

Table 2.3

Estimated annual pollution loads of the Mediterranean from land-based sources

Pollutant	Pollution loads originating in the coastal zone				Loads carried by river into the Mediterranean				Total Mediterranean Loads		
	Domestic t/a	Industrial t/a	Agricultural t/a	Sub-total t/a	Pollution t/a	Background t/a	Sub-total		Pollution	Total (including background)	
							t/a	(range)		t/a	(range)
1. <u>Volume:</u> Total discharge x10 ⁹	2	6	-*	(8)	(-)	420	420	(400-500)	(-)	430	(400-500)
2. <u>Organic matter:</u> BOD x10 ³ COD x10 ³	500 1 100	900 2 400	100 1 600	1 500 5 100	1 000 2 700	(800) 800	1 800 3 500	(1200-2300) (2300-4700)	2 500 7 800	3 300 8 600	(2700-3800) (7400-9800)
3. <u>Nutrients:</u> Phosphorus x10 ³ Nitrogen x10 ³	22 110	5 25	30 65	57 200	260 600	40 200	300 800	(200-400) (600-1000)	320 800	360 1 000	(260-460) (800-1200)
4. <u>Specific organics:</u> Detergents x10 ³ Phenols x10 ³ Mineral oil x10 ³	18 - -	- 11 120	- - -	18 11 120	42 1 (-)	0 0 0	42 1 (-)	(9-75) (0.5-1.8)	60 12 (120)	60 12 (-)	(30-90) (6-18)
5. <u>Metals:</u> Mercury Lead Chromium Zinc	0.8 200 250 1 900	(7) 1 400 950 5 000	- - - -	(8) 1 600 1 200 6 900	90 2 200 1 200 14 000	30 1 000 400 4 000	120 3 200 1 600 18 000	(40-200) (2700-3800) (500-2700) (14000-22000)	100 3 800 2 400 21 000	130 4 800 2 800 25 000	(50-200) (4300-5400) (1700-3900) (21000-29000)
6. <u>Suspended matter:</u> TSS x10 ⁶	0.6	2.8	50	53	-	300	300	(100-500)	-	350	(100-600)
7. <u>Pesticides:</u> Organochlorines	-	-	-*	-	90	0	90	(50-200)	90	90	(50-200)
8. <u>Radioactivity:</u> Tritium Ci/a Other radio-nuclides Ci/a	- -	400 25	- (-)	400 25	2 100 15	(-) (-)	2 100 15	(1600-3100) (10-25)	2 500 40	(-) (-)	

Legend: - contributions from this source negligible
 (-) insufficient data base for estimate

2.8. The report of the survey included the conclusion that compilation and comparison of the sectorial results achieved revealed a number of interesting facts which could assist in the improvement of current pollution control efforts by the countries bordering the Mediterranean Sea. In particular, it was concluded that:

- (a) Domestic sources largely contributed organic matter (BOD or COD), microbial pollution and nutrients, as well as detergents from household uses. Some of the metals were also derived from municipal sewage discharges;
- (b) Industrial waste discharges were responsible for considerable amounts of organic matter and suspended solids. Various industrial processes resulted also in phenol and metal releases, while mineral oils were largely introduced from refineries and crude oil terminals;
- (c) Agricultural run-off was responsible for a considerable portion of the nutrient input to the sea. Suspended solids and pesticide discharges were largely due to soil erosion in the Mediterranean watershed. However, the contributions from agricultural run-off within the coastal area was but a fraction of the pollution loads carried by rivers into the sea. The air-borne load of pesticides could not, however, be included in the study;
- (d) Major rivers and drains transported an integrated load of domestic, industrial and agricultural pollutants from the entire drainage basin into the sea. Their contribution was therefore very high in suspended solids, nutrients, metals and organic matter. They also carried most of the pesticide residues from agricultural areas in the Mediterranean watershed;
- (e) The total discharge of radioactivity into the Mediterranean from nuclear installations was rather low in comparison to the radioactive contaminants in other materials discharged (particularly phosphates).

2.9 The survey report stressed that the 1976-1977 project should be considered as only a first step towards the required efforts at pollution control in the Mediterranean, and made a number of specific proposals for follow-up action, including the compilation of source inventories, the performance of monitoring and research, and the improvement of control and management.

3. ORGANIZATION OF THE CURRENT SURVEY

3.1. The second survey on pollutants from land-based sources in the Mediterranean was designed to provide an updated view of the general situation both in itself and in comparison with the previous situation as shown by the results of the first survey (MED X). The survey was approved by the December 1985 meeting of experts on technical implementation of the land-based sources protocol, and later by the Contracting Parties to the Convention and protocols at their Fifth Ordinary Meeting in Athens in September 1987, after the general content of the relevant questionnaires to be prepared had already been agreed on by national MED POL coordinators at their Fourth Working Group Meeting in Athens in June 1986. This meeting had decided that:

- (a) The questionnaires should initially cover only information on liquid domestic discharges, and on cadmium, mercury, organochlorine and petroleum hydrocarbons as industrial pollutants, and should take into account the forms of the Paris Convention;
- (b) Draft questionnaires should be sent to national coordinators by the end of July 1986 for comment; the comments of the national coordinators should be sent to the Unit by the end of November 1986; the questionnaires would be revised by the Unit accordingly and officially submitted to governments by the end of December 1986; the questionnaires should be completed and returned to the Unit by September 1987; and the Unit would prepare a full report by April 1988.

3.2. In effect, the time-table quoted in (b) above was optimistic in the extreme. The questionnaires, while taking the forms used in the Paris Convention into account, were drafted mainly on the basis of the 1976-1977 questionnaires to facilitate comparison, and their preparation in such a way as to restrict them to the parameters agreed on by the meeting involved considerable time. They were then reviewed during a WHO/UNEP consultation meeting on monitoring of land-based sources of pollution in the Mediterranean, held in Split from 1 to 5 December 1987. In reviewing the questionnaires, the meeting agreed that national MED POL coordinators should be requested to consider the advisability of expanding the list of parameters previously agreed on, to minimize practical and technical problems where different pollutants were discharged concurrently, and to prevent the duplication of effort that would arise in later surveys. In this regard the meeting considered that the questionnaire on industrial pollutants should also include other heavy metals, as well as other appropriate substances from Annexes I and II to the protocol. The questionnaires were modified on the basis of these recommendations, and submitted to national MED POL coordinators in November 1988. Following receipt of comments from a number of national coordinators, the final versions of the questionnaires were formally submitted, again to national MED POL coordinators, in June 1989 for completion. Due to the delay of the submission of the questionnaires to the MED POL Programme, several reminders were sent to MED POL Coordinators, the last one being sent on 11 July 1995.

3.3. The questionnaires concerned the following:

- (a) Liquid domestic discharges;

- (b) Industrial discharges containing selected substances listed in Annexes I and II to the land-based sources protocol;
- (c) Industrial discharges of petroleum hydrocarbons, including sub-questionnaires on discharges from oil refineries and reception facilities respectively.

3.4. The set of questionnaires used is reproduced in Annex 1 to this document.

3.5. Both in the original covering letter to the questionnaires and in subsequent correspondence, national MED POL coordinators were offered assistance in the completion of the questionnaires. This offer of assistance included:

- (a) expert visits to assist in the organization of the necessary work and, where necessary, to evaluate it;
- (b) small financial contributions to the cost of completion of the questionnaires themselves by local personnel.

3.6. Where appropriate, the survey work was integrated with ongoing projects being conducted within the framework of the Coastal Areas Management Programme (CAMPS). Apart from providing an essential input into the CAMPS projects themselves, the experience gained at local level would provide the basis for completion of the questionnaires for the rest of the country.

Provision of expert advice and financial assistance, and status of implementation

3.7. A summary of assistance to countries in the form of (a) expert advice, and (b) financial assistance for the recruitment of *ad hoc* local personnel for completion of the questionnaires, is provided in Table 3.1. The status of implementation is given in Table 3.2.

Table 3.1

Assistance provided to countries participating in the current survey

Albania	Expert advice (1993)
Croatia	Expert advice (1990). Financial assistance (1992)
Cyprus	Expert advice (1990)
Egypt	Financial assistance (1993)
Greece	Expert advice (1990). Financial assistance (1994)
Morocco	Expert advice (1991).
Slovenia	Expert advice (1990). Financial assistance (1992)
Syria	Expert advice (1992). Financial assistance (1993)
Tunisia	Expert advice (1991).

Table 3.2

Status of implementation of project in individual countries

Albania	Completed questionnaires received in part
Algeria	Completed questionnaires received in part
Bosnia	-----
Croatia	Completed questionnaires received in part
Cyprus	Completed questionnaires received in part
Egypt	Qualitative report received
France	Completed questionnaires received in part
Greece	Completed questionnaires received in part
Israel	No information regarding date of completion of questionnaires
Italy	No information regarding date of completion of questionnaires
Lebanon	No information regarding date of completion of questionnaires
Libya	No information regarding date of completion of questionnaires
Malta	No information regarding date of completion of questionnaires
Monaco	Completed questionnaires received
Morocco	No information regarding date of completion of questionnaires
Slovenia	Completed questionnaires received in part
Spain	Completed questionnaires received in part
Syria	Completed questionnaires received in part
Tunisia	No information regarding date of completion of questionnaires
Turkey	Consolidated report received + completed questionnaires received in part

3.8. Most of the replies received related to the first questionnaire, dealing with liquid domestic discharges. In many of the questionnaires returned, various data were omitted, *i.e.* the questionnaires were only partially completed. In some cases, only reports were received. The fact that no reply was received from Italy left a considerable gap in the Central Mediterranean.

Table 3.3

Survey on pollutants from land-based sources
in the Mediterranean

Countries	Questionnaires submitted and related to				
	1	2	3a	3b	3c
ALBANIA	X	X	-	X	-
ALGERIA	-	-	X	X	-
CROATIA	X	-	-	-	-
CYPRUS	X	*	-	X	-
EGYPT	-	X	-	-	-
FRANCE	X	*	-	-	-
GREECE	X	-	-	-	-
MONACO	X	-	-	-	-
SLOVENIA	X	-	-	-	-
SPAIN	X	*	-	X	X
SYRIA	X	X	-	X	-
TURKEY	X	X	*	*	-

Questionnaire 1: on liquid domestic discharges

Questionnaire 2: on industrial discharges containing selected substances listed in Annexes I and II to the protocol for protection of the Mediterranean Sea against pollution from land-based sources

Questionnaire 3a: on industrial discharges of petroleum hydrocarbons

Questionnaire 3b: on oil discharges from refineries

Questionnaire 3c: on oil discharges from reception facilities.

* Data received cover small part of the country.

4. INTERIM RESULTS OF THE CURRENT SURVEY

4.1. Replies to the questionnaire on liquid domestic discharges (form MED/X/BIS/1) were received from ten countries: Albania, Croatia, Cyprus, France, Greece, Monaco, Slovenia, Spain and Syria. Information from Turkey was received partly in the form of completed questionnaires and partly in the form of a report. In most cases, the questionnaire forms were only partially filled in, and a considerable amount of the information requested was missing. More specifically, the following countries have submitted data for the number of settlements as follows: Albania 4, Croatia 7, Cyprus 4, France 50, Greece 531, Monaco 1, Slovenia 3, Spain 203, Syria 12, Turkey 25.

4.2. Replies to the questionnaire on Industrial discharges containing selected substances listed in Annexes I and II to the land-based sources protocol (form MED/X/BIS/2) were received only from seven countries: Albania, Cyprus, Egypt, France, Spain, Syria and Turkey. In most cases, however, only a few questionnaire forms were received per country, and the data provided in practically all cases were poor.

4.3. Replies to the questionnaires on Industrial discharges of petroleum hydrocarbons (form MED/X/BIS/3a) and the sub-questionnaires on discharges from oil refineries (form MED/X/BIS/3b) and reception facilities (form MED/X/BIS/3c) were received only from seven countries: Albania, Algeria, Croatia, Cyprus, Spain, Syria and Turkey. The replies dealt mainly with discharges from oil refineries.

4.4. An evaluation of the information contained in the completed questionnaires received is contained in the following sections of this report.

4.1. Municipal wastewater production and collection

4.5. In practically all the countries from which completed questionnaires were received, the population of the coastal areas covered was reported to increase during the Summer months. The average increase reported was above 69%, with a range of 0% (Syria) to 115% (Spain). This is shown in Figure 4.1. The high Summer increase in population confirms the well-known fact that the coastal areas of most Mediterranean countries are very important holiday destinations for both domestic and foreign tourists, as is shown in Table 4.1.

4.6. The average values for wastewater production in the countries in question is 152 litres per person per day. Owing to the very high variation in population numbers during the year, this value is very hypothetical. Despite this, it could be pointed out that the average wastewater production differs greatly in amount between the various countries. The highest value (240 litres / person / day) was reported from Croatia, and the lowest (112 litres / person / day) was reported from Slovenia. There was also a considerable difference between countries which are highly developed for tourism. The values for France and Spain were reported at 196 litres / person / day and 126 litres / person / day respectively.

4.7. The main method of collection of wastewater produced is the municipal sewer system. On average, more than 79% of the population covered was reported to be served by such a system, with less than 0.8% served by other sewer systems, 17% served by other (non-sewer) systems and 2.8% not served by any system. The information is shown in Table 4.2 and Figure 4.2.

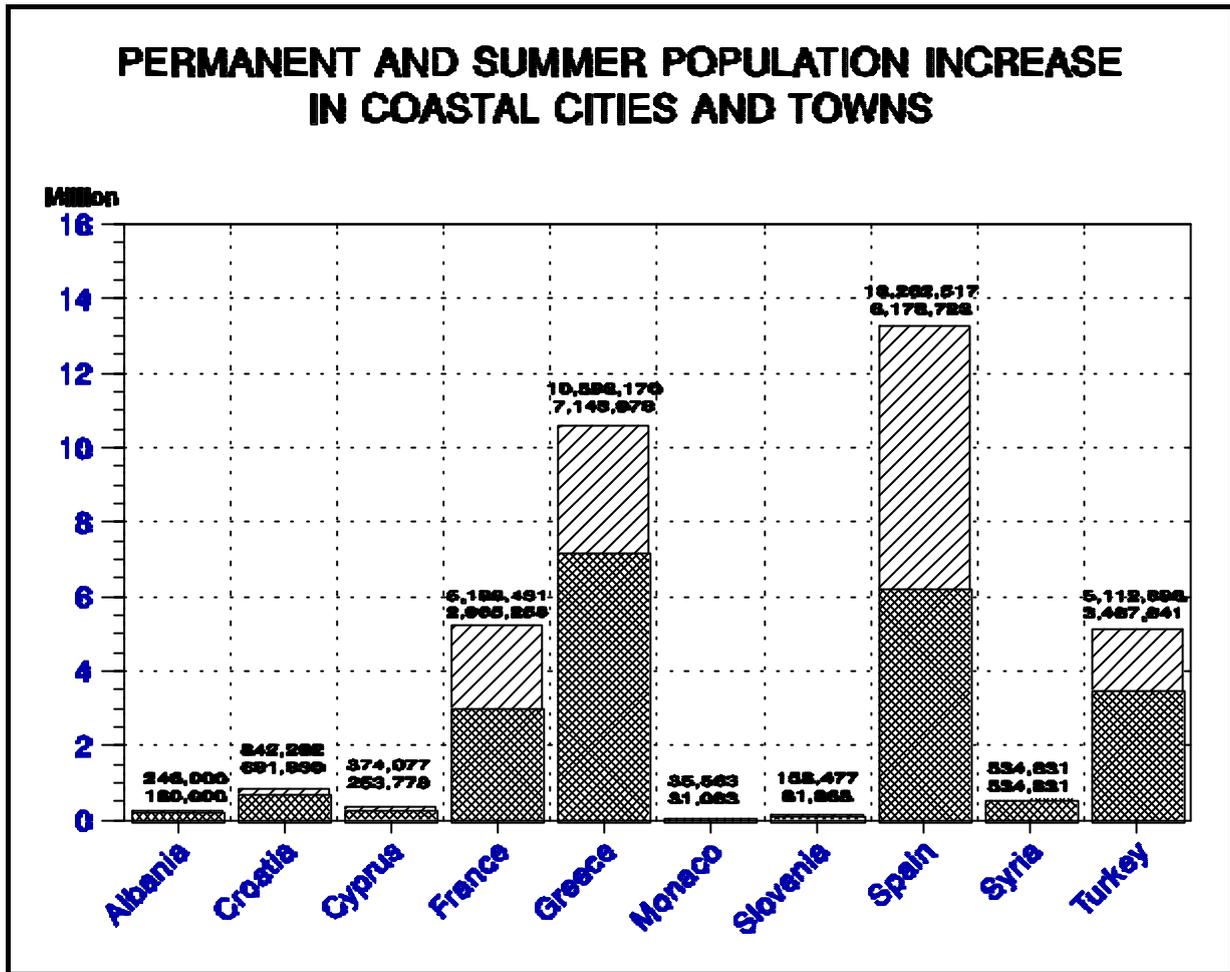


Figure 4.1

Table 4.1

Population, water consumption and wastewater quantity

No.	COUNTRY	POPULATION		WATER CONSUMPTION 10 ³ m ³ /month		WASTE WATER		
		NORMAL	AVERAGE SEASONAL INCREASE	NORMAL	PEAK	PRODUCTION	DISCHARGED INTO THE SEA OR RIVER	
						10 ⁶ m ³ /yr	10 ⁶ m ³ /yr	%
1.	ALBANIA	174,000	66,000	888.00	880.00	8.52	7.92	92.96
2.	CROATIA	677,830	160,462	6,685.57	7,662.87	71.44	59.81	83.72
3.	CYPRUS	249,778	120,299	1,662.55	2,227.92	16.66	0	0
4.	FRANCE	2,961,258	2,234,173	-	-	361.02	359.52	97.65
5.	GREECE	7,139,978	3,499,192	-	-	520.26	226.36	43.50
6.	MONACO	27,063	4,500	13.00	18.00	7.50	7.50	100.00
7.	SLOVENIA	77,365	77,112	730.00	899.99	6.13	5.08	82.87
8.	SPAIN	6,174,723	7,083,794	-	-	589.29	494.76	83.96
9.	SYRIA	530,831	-	2,488.29	-	24.80	24.80	100.00
10.	TURKEY	3,463,641	1,645,257	16,35	20,60	404.87	358.78	88.61
	TOTAL	21,476,467	14,890,789	27,154.76	32,288.79	2010.50	1,691.94	84.15

Table 4.2

Population, waste water systems and treatment at the municipal sewer system

NO.	COUNTRY	POPULATION		ESTIMATED POPULATION SERVED			SEWAGE TREATMENT AT THE MUNICIPAL SEWER SYSTEM				
		NORMAL	AVERAGE SEASONAL INCREASE	TO THE MUNICIPAL SEWER SYSTEM	TO OTHER SEWER SYSTEMS	SERVED BY OTHER SYSTEMS	PRELIM.	PRIMARY	CHEM.	SECONDARY	TERT.
1.	ALBANIA	174,000	66,000	222,000	0	-	0	0	0	0	0
2.	CROATIA	677,830	160,462	603,145	10,577	194,579	0	0	0	0	0
3.	CYPRUS	249,778	120,299	0	25,594	342,483		0	0	0	0
4.	FRANCE	2,961,258	2,234,173	4,667,700	0	0	0	0	0	3,890,350	0
5.	GREECE	7,139,978	3,449,192	6,333,348	12,700	4,228,703	7,800	3,028,400	0	1,705,120	0
6.	MONACO	27,063	4,500	45,134	0	0	0	0	0	45,134	0
7.	SLOVENIA	77,365	77,112	135,194		18,455	0	0	0	0	0
8.	SPAIN	6,174,723	7,083,794	12,692,167	241,585	229,572	1,106,763	324,086	0	7,034,948	0
9.	SYRIA	530,830	-	512,167	-	11,070	0	0	0	0	0
10.	TURKEY	3,463,641	1,645,277	3,585,463	0	1,195,000	1,204,539	0	0	1,159,359	0
	TOTAL	21,476,466	14,890,789	28,796,318	290,456	6,219,862	2,319,102	3,352,486	0	13,834,911	0

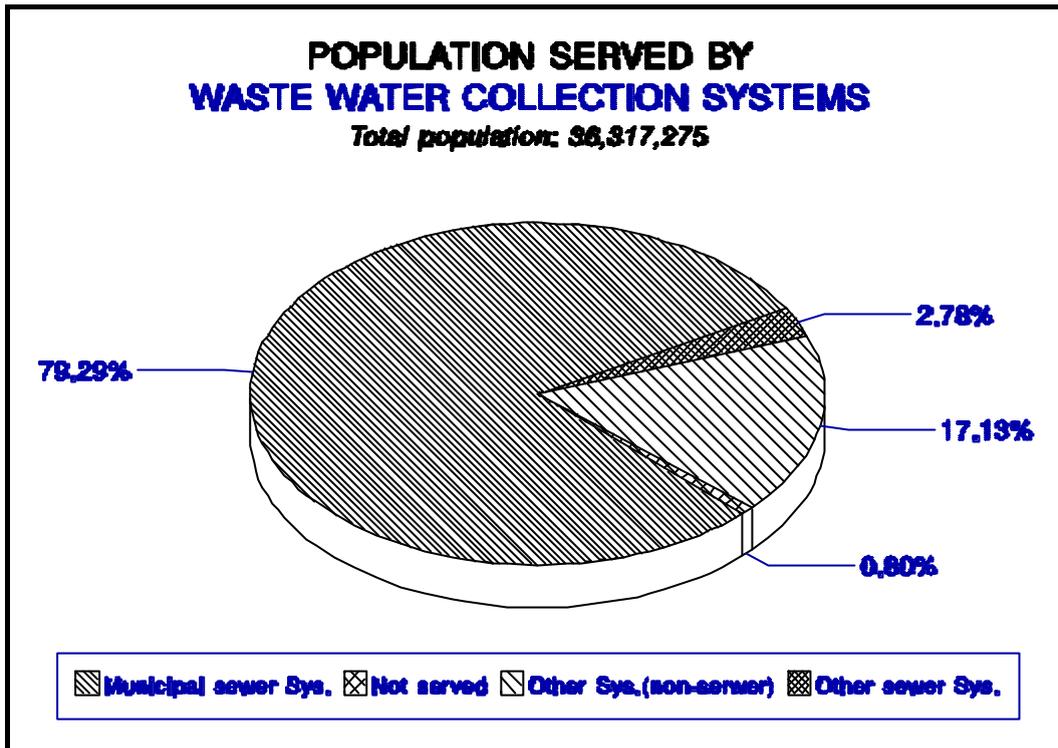


Figure 4.2

4.8. From the data received, it emerges that in France, more than 10% of the population in the Mediterranean coastal area is not served by any wastewater system. The percentage is lower in some countries (7.5% in Albania, 6.4% in Turkey, and 3.6% in Croatia) and practically negligible (less than 1%) in others, while in Monaco and Syria, the whole coastal population is served by some type of sewer system.

4.9. In Cyprus, other sewer systems (which are complementary to the municipal system) are in evidence, and serve 6.9% of the population. The population percentage served by this type of system is either much smaller in a number of countries (1.8% in Spain, 1.3% in Croatia and 0.1% in Greece), while in others, this method of wastewater collection is not practised at all. Sewer systems other than municipal ones are mainly constructed specifically for large tourist complexes located away from existing settlements.

4.10. The percentage of other systems (which include cesspits, septic tanks, etc.) used for the management of urban domestic wastewater is unexpectedly high - 17% for the part of the Mediterranean region covered by the replies to the questionnaire. Cyprus and Greece are the countries where this method is most widely practised in domestic wastewater collection, population percentages served by this method being 92.5% and 40% respectively. In Croatia and Turkey, approximately 23% of the coastal population is served by this method.

4.2. Municipal wastewater treatment

4.11. The relevant data on municipal wastewater treatment in the countries responding to the questionnaire are summarised in Table 4.3. The total volume of wastewater produced in these countries is 2010.5 million cubic metres. About 33% of this total remains untreated, while the rest undergoes varying levels of treatment, as shown in Figure 4.3.

4.12. The percentage of treated wastewater varies from country to country. In Albania, all the wastewater remains untreated. This is also practically the case in Syria. 85% of wastewater remains untreated in Croatia and Cyprus. In the other countries covered by the questionnaire responses, more than half of the total wastewater is treated. The percentage of untreated wastewater is 43.46 in Greece, 31 in Spain, 25.5 in Turkey, 18 in Slovenia and 13 in France. Monaco is the only country where the total amount of wastewater produced is treated before disposal into the sea.

4.13. About 62% of the treated wastewater undergoes some form of secondary treatment, mainly through the activated sludge process. Of the remaining amount, about half undergoes primary treatment and the other half preliminary treatment before disposal. The level of treatment varies in the different countries. As much as 87% of the total wastewater in France undergoes secondary treatment, corresponding figures being 59% for Spain 21.09% for Turkey and 13.92% for Greece. In Monaco, all the wastewater produced undergoes secondary treatment.

4.14. 270.996 million cubic metres of wastewater, equivalent to 13.5% of the total amount produced, undergoes only preliminary treatment. The highest percentage is from Turkey (53.42%), followed by those from Croatia (13%) and Spain (8%). In the other reporting countries, no wastewater is treated solely at the preliminary level. The global percentage of wastewater undergoing primary treatment only is 12.1%. This is based on data from two countries, Greece and Slovenia, where percentages of wastewater treated only up to this level were reported as being 42.43% and 82% respectively.

4.14 bis. Treatment at municipal sewer systems is carried out in five countries (France, Greece, Monaco, Spain and Turkey) while in four additional countries (Croatia, Cyprus, Slovenia and Syria) municipal waste water is treated on other sewer systems. With regard to sewage treatment at municipal sewer systems in terms of population served, 38% of the population is served with secondary treatment, 9.2% with primary only, and 6.4% with preliminary only (Table 4.2 and Figure 4.3 bis). In Monaco 100% of the population is served by the municipal sewer system with secondary treatment, 75% in France, in Spain 53%, in Turkey 22%, and in Greece 16%. In Greece 29% of the population is served by municipal sewer systems with primary treatment only, in Spain this percentage is only 2,5, while in other countries only primary treatment is not employed. Preliminary treatment only is in practice in Greece, Spain and Turkey, the percentage of population served being 0.07, 8.3, and 23.6, respectively.

Table 4.3

Estimated annual amount of municipal waste water and treatment level

No.	COUNTRY	TOTAL WW 10 ⁶ m ³ /yr	UNTREATED WW 10 ⁶ m ³ /yr	%	TREATED WASTE WATER					
					PRELIM.	%	PRIM.	%	SEC.	%
1.	ALBANIA	8.52	8.52	100	0	0	0	0	0	0
2.	CROATIA	71.44	61.78	86	9.51	13	0	0	0.15	0.2
3.	CYPRUS	16.66	14.75	88	0	0	0	0	2.05	12
4.	FRANCE	361.00	47.70	13	0	0	0	0	313.20	87
5.	GREECE	520.26	226.36	43.46	0	0	220.74	42.43	72.39	13.92
6.	MONACO	7.50	0	0	0	0	0	0	7.5	100
7.	SLOVENIA	6.13	1.09	18	0	0	5.04	82	0	
8.	SPAIN	589.29	180.62	31	45.22	8	17.3	3	346.15	59
9.	SYRIA	24.80	24.51	99	0	0	0	0	0.29	1
10.	TURKEY	404.87	103.23	25.5	216.26	53.42	-	-	85.37	21.09
	TOTAL	2010.47	668.56	33.25	270.996	13.50	243.08	12.10	827.10	41.15

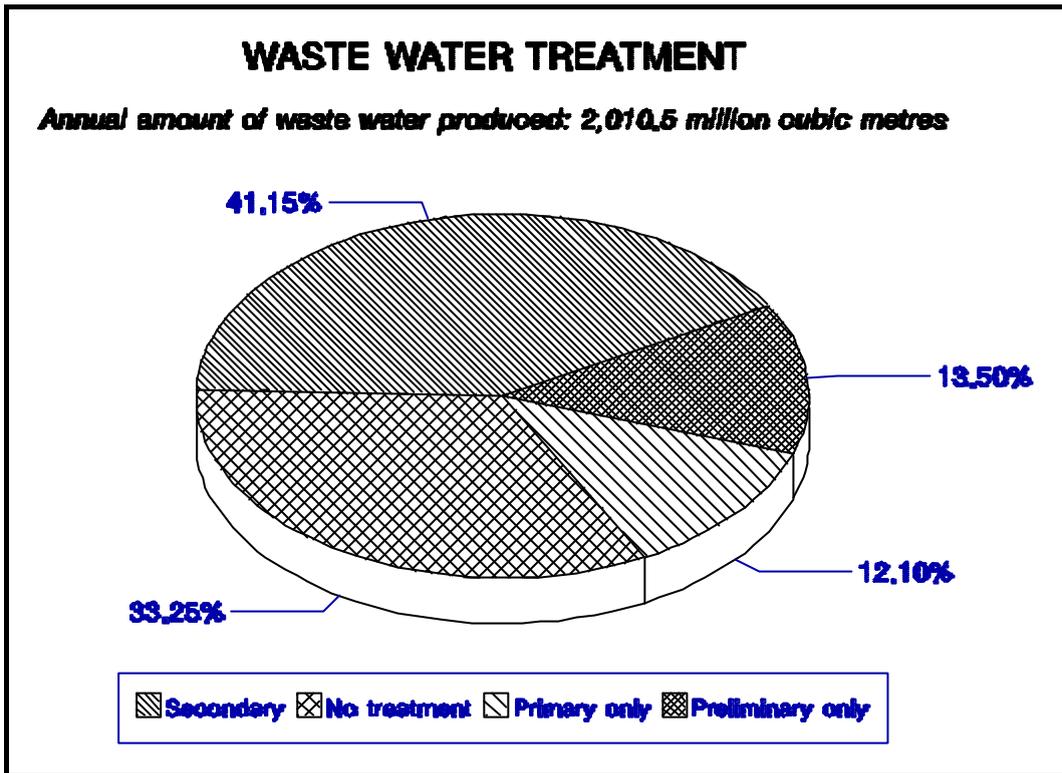


Figure 4.3

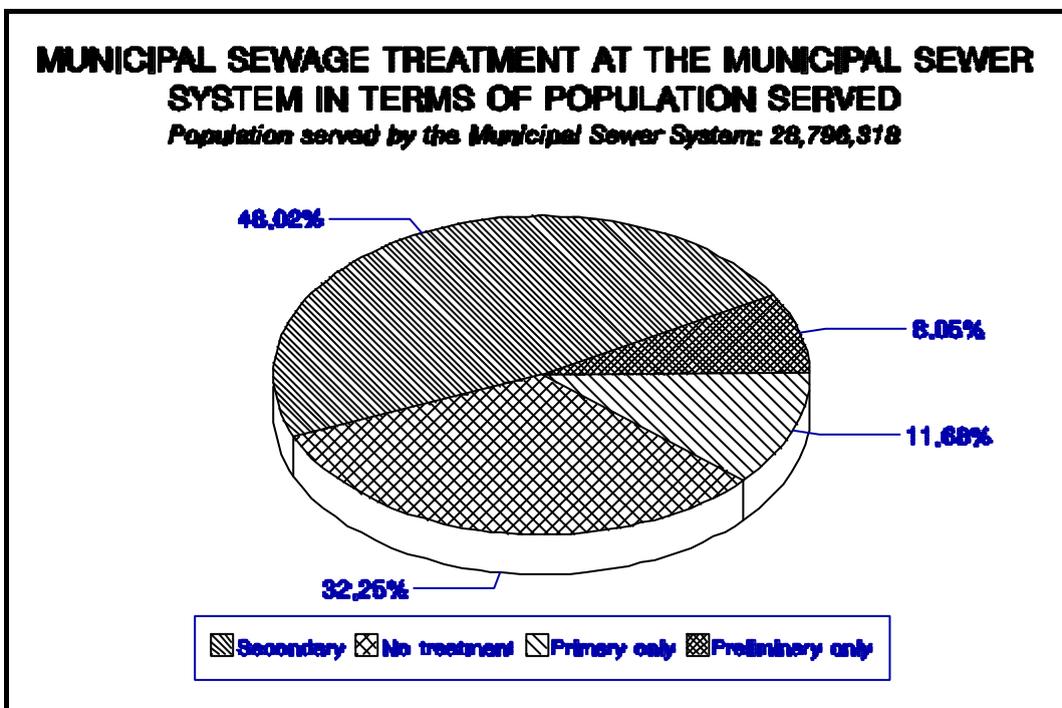


Figure 4.3 bis

4.3 Municipal wastewater and sludge disposal

4.15. In the Mediterranean region, the sea has been historically used as the most convenient recipient for domestic and other types of waste. Domestic wastewater being collected by simple pipe systems and discharged into the sea by gravity. The information collected through the survey questionnaires shows that, even at the present time, the greater part of municipal wastewater in the region is discharged into the sea, either directly, or indirectly through rivers.

Out of 2010.5 million cubic metres of wastewater produced per year, 1691.9 million cubic metres, representing 84.15% of total wastewater production, are discharged into the sea or into rivers. The data are summarised in Table 4.4 and Figure 4.4. Zero discharge of domestic wastewater into the sea is reported from only one country (Cyprus). In Greece, only 43.5% of domestic wastewater is discharged into the sea. In other countries, discharge of wastewater into the sea varies between 93% and 100%.

4.16. Submarine outfall structures enable discharge of wastewater far enough from the coastline, and at a sufficient depth, to avoid serious negative effects of the discharged waste on the immediate coastal marine environment and its users. In the Mediterranean region, during the year 1991 (which was the basic year reported on by most countries replying to the questionnaire), 125 submarine outfall structures were operational. The total amount of wastewater discharged into the sea through these structures was reported as over 936 million cubic metres (over 55% of the total amount of domestic wastewater discharged into the sea). Out of this quantity, 344.6 million cubic metres (36.8%) were discharged without any treatment or after only preliminary treatment. A further 313.5 million cubic metres (18% of the total discharged) was discharged after undergoing secondary treatment.

4.17. Discharge of domestic wastewater into the subsoil is the most common method of disposal in Cyprus (83.6%). It is performed to a significant extent in Greece (26.2%). In the region as a whole as represented by the countries replying to the questionnaire, only 153.8 million cubic metres, representing 7.6% of the total amount of wastewater produced, are disposed of in this manner. Discharges on land and elsewhere are the least common (2.1% and 0.6% respectively). Discharge on land is practised relatively extensively only in Turkey (42 million cubic metres, representing 10.37% of the total wastewater produced).

4.18. A relatively small amount of municipal sludge is utilised. The greater part (53%) is disposed on land or in other (not indicated) manners, 32% of the sludge is discharged into the sea, and only approximately 10% is used in agriculture. The relevant data are presented in Table 4.5 and Figure 4.5. In Cyprus and Croatia, the whole amount of sludge produced is discharged into the sea. Corresponding figures for France and Spain are 20% and 37% respectively. No information being provided, however, regarding the methods of disposal of the remainder, which constitutes the majority of sludge production in the respective countries.

Table 4.4

Municipal waste water deposition

No	COUNTRY	TOTAL URBAN WASTE WATER (million m ³ /year)	ESTIMATED ANNUAL DISCHARGE (million m ³ /year)							ESTIMATED ANNUAL AMOUNT OF WASTE WATER RE-USED (million m ³ /year)					
			INTO THE SEA OR RIVER			ON LAND	IN SUB-SOIL	OTHER	SUB-TOTAL	IN IRRIGATION PONDS	IN FISH PONDS	IN INDUSTRY	IN RECREAT. AREAS	IN RECHARGES	SUB-TOTAL
			THROUGH MUNICIP. SEWER SYSTEM	THROUGH OTHER SEWER SYSTEM	SUB-TOTAL										
1	ALBANIA	8.52	7.92	-	7.92	-	0.60		0.60		-	-	-	-	-
2	CROATIA	71.44	50.23	9.58	59.81	-	-	11.60	11.60		-	-	-	-	-
3	CYPRUS	16.66	-	-	-	0.36	14.38	0.84	15.58		-	-	1.11		1.11
4	FRANCE	361.00	359.52	-	359.52	-	1.50	-	1.50		-	-	-	-	-
5	GREECE	520.26	373.76	0	373.76	0.29	36.33	1.53	136.63	1.53	0	0	0	0	1.53
6	MONACO	7.50	7.50	0	7.50	0	0	0	0	0	0	0	0	0	0
7	SLOVENIA	6.13	5.08	-	5.08	-	0.94	0.11	1.05	0	0	0	0	0	0
8	SPAIN	589.29	489.08	5.68	494.76	0.33	-	-	0.33	91.24	-	0.05	3.69	-	94.98
9	SYRIA	24.80	24.45	0.35	24.8	-	-	-	-	-	-	-	-	-	-
10.	TURKEY	404.87	358.48	0.30	358.78	42.20	0	0	42.00	4.08	0	0	0.12	0	4.18
	TOTAL	2,010.47	1676.02	15.91	1691.93	42.91	53.75	12.40	209.29	96.85	0	0.05	4.92	0	101

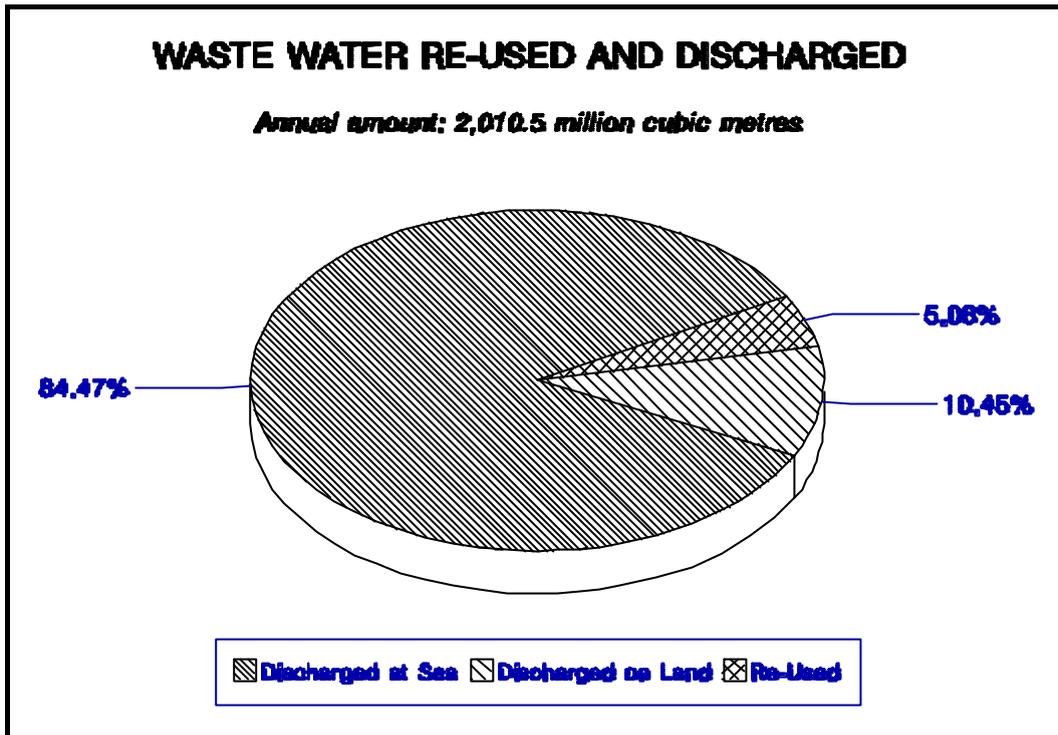


Figure 4.4

Table 4.5

Municipal sludge disposal

No.	COUNTRY	TOTAL 000 m ³ /yr	DISCHARGED 000 m ³ /yr	AGRICULTURE 000 m ³ /yr	DISCHARGED + AGRICULTURE 000 m ³ /yr	OTHER OR NOT INDICATED 000 m ³ /yr
1.	ALBANIA	0	0	0	0	0
2.	CROATIA	1.75	1.75	0	0	0
3.	CYPRUS	5.30	5.30	0	0	0
4.	FRANCE	1,207.37	251.26	155.05	24.62	776.44
5.	GREECE	-	-	-	-	-
6.	MONACO	91.50	0	0	0	91.50
7.	SLOVENIA	0	0	0	0	0
8.	SPAIN	3,980.85	1,460.95	381.05	194.99	1,943.87
9.	SYRIA	0	0	0	0	0
10.	TURKEY	67.94	0	0	27.94	40
	TOTAL	5354.71	1719.26	536.10	247.55	2851.81

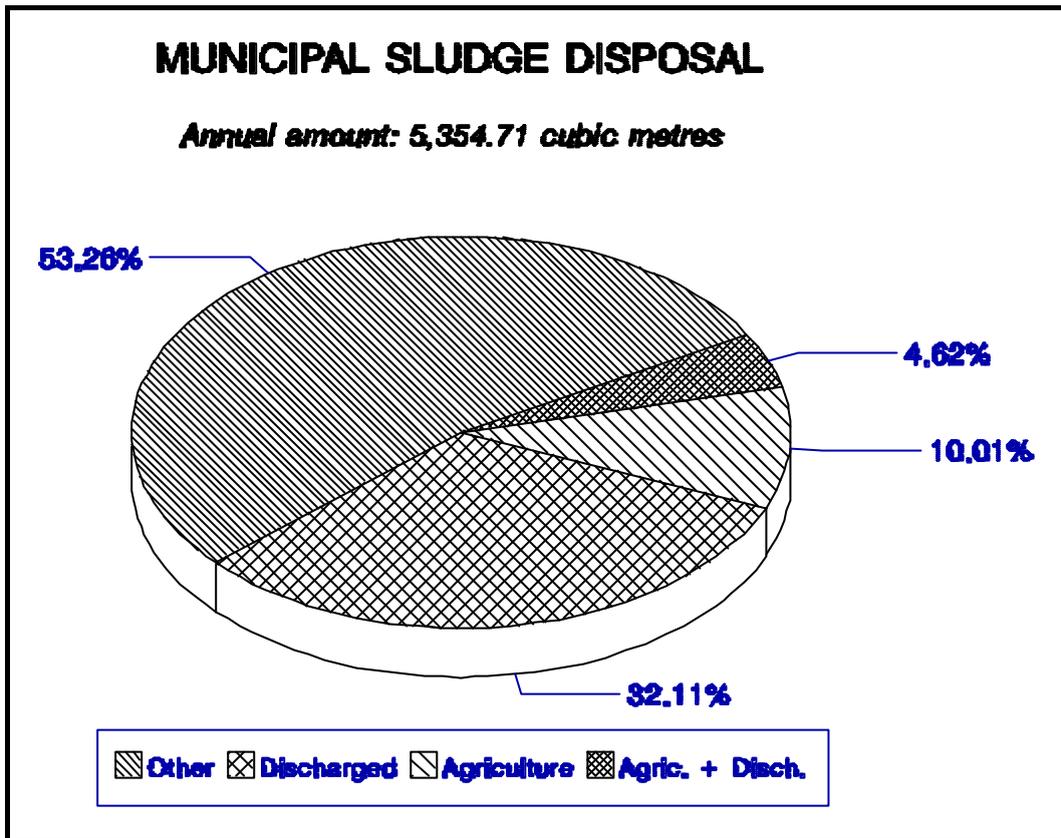


Figure 4.5

4.4. Municipal wastewater re-use

4.19 The amount of municipal wastewater re-used in the Mediterranean countries responding to the questionnaire is relatively small, representing only 5% of the total amount of wastewater produced. Details are summarised in Figure 4.6. The situation varies between individual countries. A considerable amount of treated wastewater is re-used in Spain and Turkey (16% and 10% of the total amount of wastewater respectively), mostly for irrigation. Data are presented in Table 4.4. Small amounts of treated wastewater are re-used in recreational areas in Spain and Cyprus (0.6% and 0.66% of the total amount of wastewater respectively). Only 0.008% of the total wastewater produced in Spain is re-used in industry.

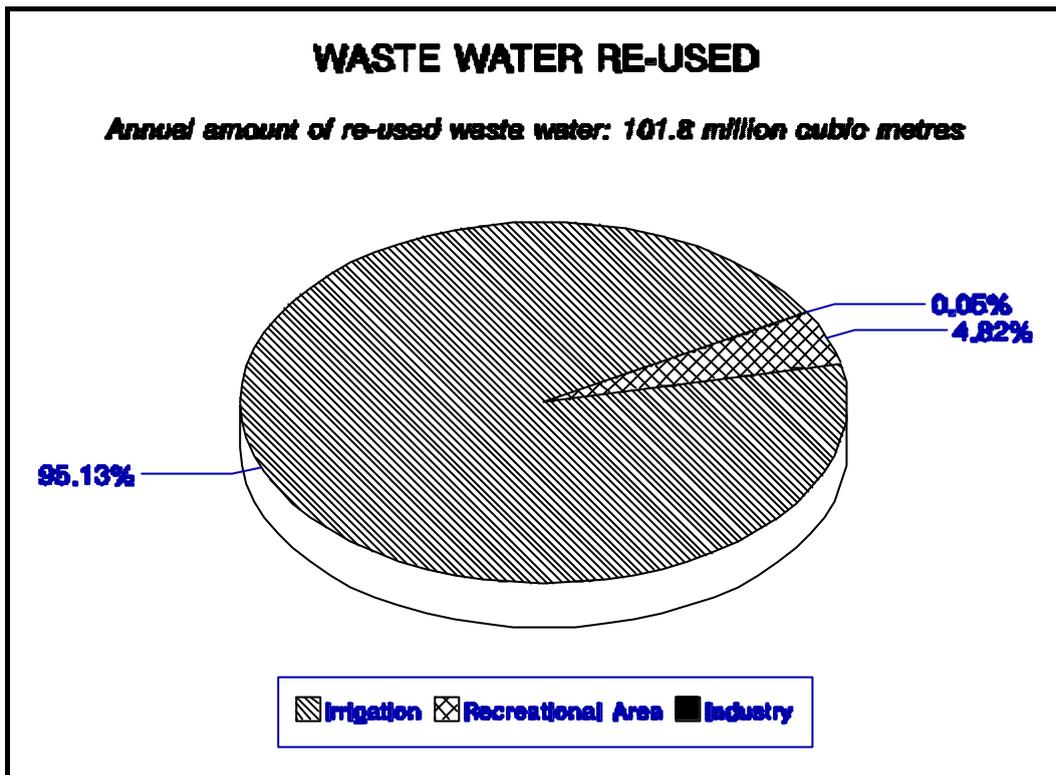


Figure 4.6

4.5. Municipal solid wastes

4.20. The total amount of municipal solid wastes produced in the countries replying to the questionnaires reached a value of 4,437,600 tonnes per year. This figure does not include data from France and Greece, which was not provided. Details are given in Table 4.6. The greater part of municipal solid waste is disposed on land. From the data received, it is not known whether disposal is carried out in sanitary landfills or in dumping sites. Only 4% of solid wastes produced are incinerated, and 14.94% composted. Details are summarised in Figure 4.7. The greatest percentage of solid waste composted is in Syria (30%), followed by Cyprus and Spain (8.5% of the total solid waste produced in each case).

4.6. Industrial wastewater

4.21. The amount of data received on industrial wastewater, has been very limited so far. Replies to the questionnaire on Industrial discharges containing selected substances listed in Annexes I and II to the land-based sources protocol (form MED/X/BIS/2) were received only from seven countries (Albania, Cyprus, Egypt, France, Spain, Syria and Turkey). Some of these countries returned only a few questionnaire forms, and in all cases, the data received was very poor, the questionnaires being only partially completed. On the basis of information received, therefore, it is impossible to assess the amount of industrial waste discharged into the sea, or to evaluate the present situation regarding industrial waste management in the region.

4.22. Among the medium to large Mediterranean countries, Turkey was the only one to submit information on a relatively large number of industrial establishments, but the major part of the information received was not received through completed questionnaires. The Turkish State Institute of Statistics has prepared a Manufacturing Industry Waste Inventory with the aims of (a) determining the existing situation on environmental pollution originating from the manufacturing industry, (b) defining the quantity and composition of solid, liquid and gaseous wastes, and (c) providing control measures and determining which waste products might be re-usable. This inventory covers 2548 establishments representing 88.33% of total production and 75.6% of personnel in industrial establishments employing 25 or more persons. The data has been evaluated for the whole country and for 74 provinces, and covers the year 1991. The Mediterranean coast of Turkey is divided among nine provinces, but data evaluated covered only 384 establishments in four of these provinces, along with some elaborated information on two more. Despite the fact that the above material, together with small number of completed questionnaires received, cover a wide range of information, data on the type and amount of substances discharged into the sea was not provided. It was not possible, therefore, to calculate the total pollution load from industry.

Table 4.6

Municipal solid wastes

No.	COUNTRY	TOTAL ktons/y	INCINERATION ktons/yr	COMPOSTING ktons/yr	OTHER ktons/yr	REMARKS
	ALBANIA	70.70	1.	-	70.70	LANDFILL?
2.	CROATIA	189.75	-	-	189.75	LANDFILL?
3.	CYPRUS	97.30	8.30	-	89.00	S.LANDFILL
4.	FRANCE	-	-	-	-	
5.	GREECE	-	-	-	-	-
6.	MONACO	13.00	13.00	-	-	-
7.	SLOVENIA	29.39	-	-	29.39	S.LANDFILL
8.	SPAIN	1,771.28	154.44	431.58	1,184.67	
9.	SYRIA	144.88	-	44.00	100.88	LANDFILL?
10.	TURKEY	2121.30	0	187.50	1933.80	LANDFILL?
	TOTAL	4437.60	175.74	663.08	3598.19	

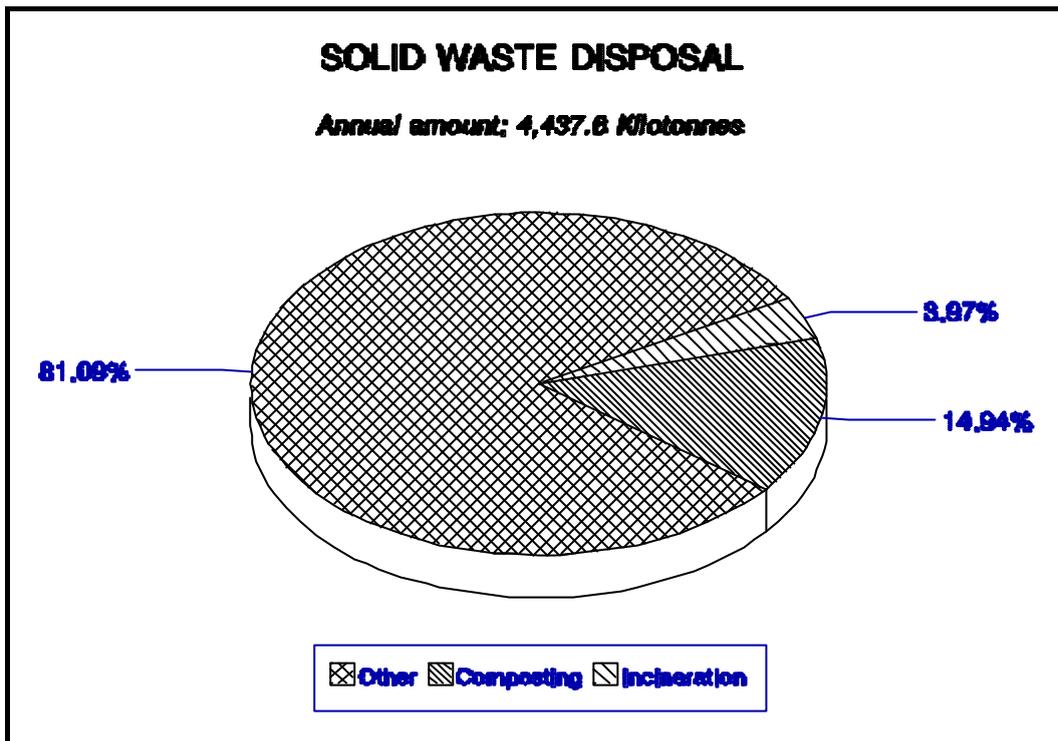


Figure 4.7

4.23. Relevant data on industrial pollution are summarised in Table 4.7, and on Figures 4.8 and 4.9. In general, on the basis of data received, it could be concluded that approximately 48% of the total amount of industrial process water is discharged untreated, while the remaining 52% is treated before discharge. Approximately 13% of the process water is discharged into municipal sewers, about 15% of this amount being treated. Approximately 14%, two thirds of which remains untreated, is discharged into rivers; 14%, again two thirds of which is untreated, on the shoreline, 1% is discharged on land or into septic tanks, and approximately 1.4% is discharged in an unspecified manner. The remainder, approximately 57% of the total amount of process water, of which 33% is untreated, is discharged into the sea directly or via outfall.

4.24. The amount of cooling wastewater is about four times greater than the amount of process water. The bulk (95%) of this is discharged untreated on the seashore, about 2% into rivers, and 0.5% directly into the sea. Less than 1% of the total cooling wastewater produced is discharged on land.

4.25. Domestic wastewater from industry amounts to only 28% of the volume of process wastewater. Approximately 92% of domestic wastewater is discharged untreated, either on the shoreline (54%), into municipal sewer systems (36%) or on land (3%).

Table 4.7

Types of waste water from industry and way of discharge

	Type of waste water					
	Process waste water		Cooling water		Domestic water	
	Untreated m ³ /y	Treated m ³ /y	Untreated m ³ /y	Treated m ³ /y	Untreated m ³ /y	Treated m ³ /y
Municipal system	15,947,125	2,906,734	3,002,094	-	10,133,345	595,260
River	13,582,751	6,458,838	6,996,300	2,930,400	1,286,932	554,375
On land	298,004	1,219,200	3,777,480	-	1,211,433	36,140
On shore	13,728,600	6,280,500	512,815,380	1,999,500	22,074,000	49,500
By outfall		19,536,000	3,600	0	0	0
Other		38,809,865		0	716,632	2,119,155
Sea	27,515,550		2,708,100			
Lake			0	0	0	0
Dam			0	0	19,200	0
Sept. tank		586,980	0	0	693,672	1,515
Other	884,086					
Other	39,199	2,004,320	0	0	652,600	29,200
Total	71,995,315	77,802,437	529,302,954	4,929,900	38,041,159	3,385,145

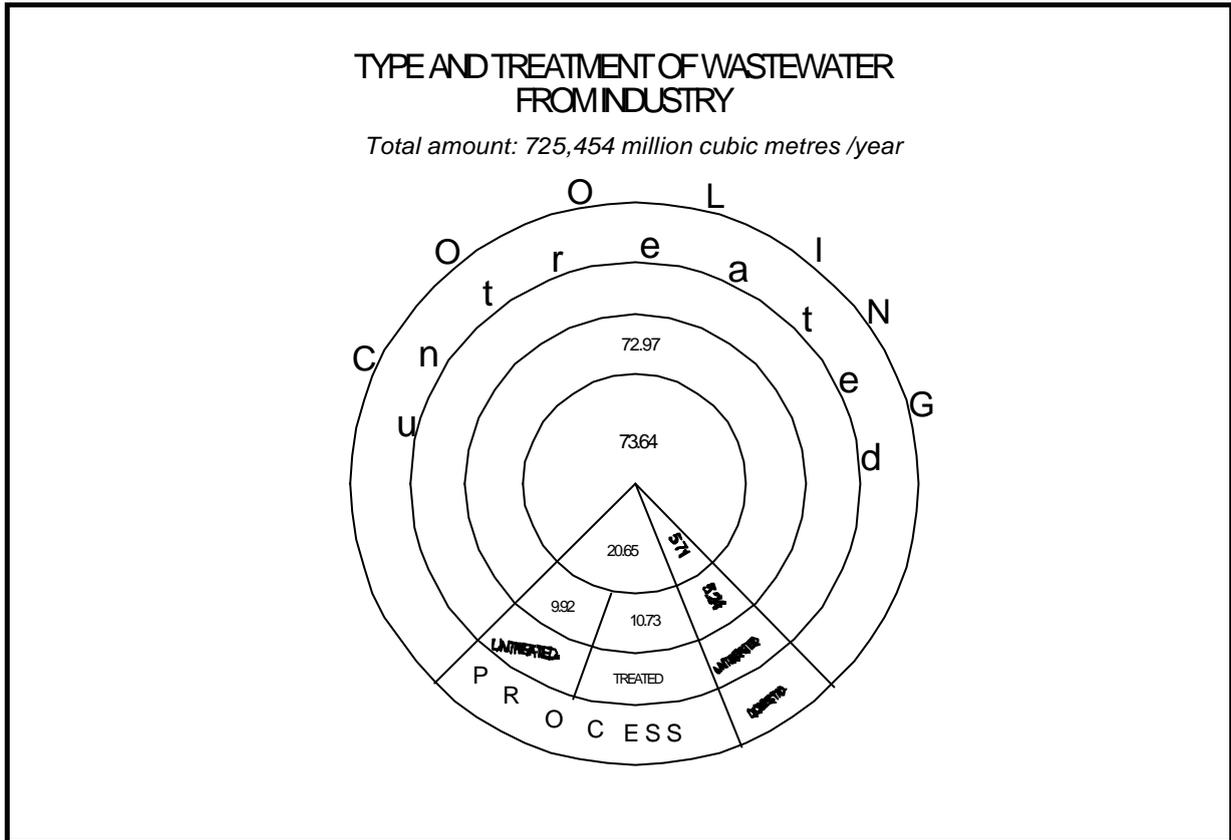


Figure 4.8

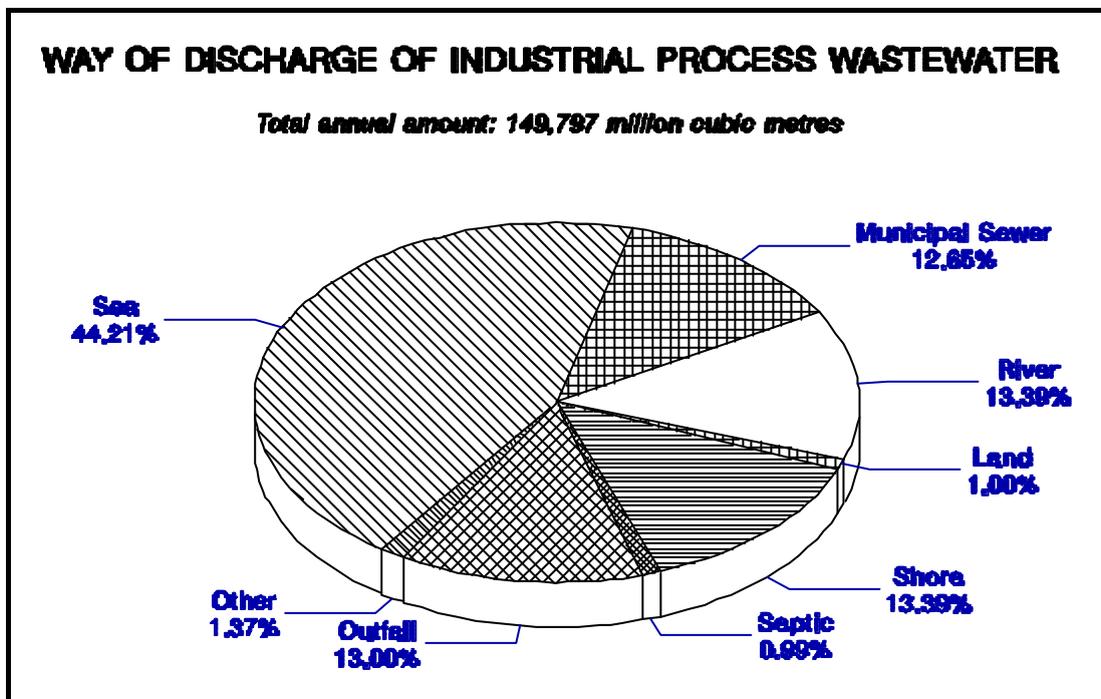


Figure 4.9

Oil discharge from refineries

4.26. Information on oil discharges from refineries were received from six Mediterranean countries: Albania, Algeria, Cyprus, Spain, Syria and Turkey, and were related to thirteen refineries. The information is summarized in Table 4.8. The total annual capacity of these refineries is approximately 70 million metric tonnes, but production in the year reported on was 62.612 million metric tonnes. The amount of oil discharged into the marine environment from these refineries was 782.43 metric tonnes, equivalent to 12.5 metric tonnes per million metric tonnes processed oil.

5. SITUATION ANALYSIS

5.1. There were problems in achieving any significant degree of correlation between the partial results of the present survey and the results of the 1976-1977 survey, because:

- (a) Replies to the current questionnaires have so far been received from only twelve countries;
- (b) The previous survey considered the Mediterranean from the point of view of ten sub-regional entities, each of which comprised the whole or part of the coastline of more than one country;
- (c) The previous survey was primarily concerned with overall pollution loads for specific substances;
- (d) The mode of approach of the previous survey was different, and results were mainly reached by indirect estimates.

5.2. Similarly, it was not possible to effect any correlation between the situation as provided from the completed questionnaires received and the results of implementation in individual countries of prevention and control measures adopted by the Contracting Parties. This was for the same reasons outlined in paragraph 5.1 above. In addition,

- (a) Evaluation of the effects of any measures in mitigation of pollution requires a direct comparison between the situation prevailing in 1976/1977 and the one prevailing at the time of completion of the questionnaires. As already explained, such a comparison could not be made,
- (b) The majority of the measures adopted by Contracting Parties since 1985 referred mainly to chemical pollutants. As has been described above, very little material on such pollutants, which originate mainly from industry, were received,
- (c) There is a relative lack of information from Contracting Parties regarding implementation of measures adopted.

Table 4.8

Oil discharges from refineries

No	Country	Capacity 10 ⁶ t/year	Cooling water t/year	Process water t/year	Ballast water t/year	Storm and other water t/year	Quantity of HC discharged t/year	Ratio of HC disch. to productio n t/10 ⁶ t	Ratio of HC discharged to capacity t/10 ⁶ t
1.	Albania	0.9	1,500,000	-	-	-	285.00	317.00	713.00
2.	Algeria	15.00	0	1,314,000	-	-	26.00	1.70	1.75
3.		3.00	420,000	1,000,000	-	-	42.60	14.20	14.20
4.		2.90	900,000	1,610,000	-	500,000	90.00	30.00	32.40
5.	Cyprus	0.79	12,000,000	20,000	-	10,000	12.00	16.60	15.20
6.	Spain	6.00	350,000	526,000	630,000	22,000	4.93	1.45	0.82
7.		8.00	682,088	1,258,527	486,521	-	39.80	5.56	4.98
8.		1.40	135,361	246,893	20,838	21,044	2.90	2.60	2.10
9.		5.00	735,840	1,252,680	534,360	-	86.00	19.40	17.20
10.		8.00	-	3,140,000	2,500,000	0	136.00	17.60	17.00
11.	Syria	6.00	0	2,000,000	-	-	20.00	3.30	-
12.	Turkey	4.40	-	800,000	300,000	400,000	4.40	1.19	1.00
		8.70	3,060,000	2,600,000	500,000	400,000	32.80	3.60	3.30
	Total	70.09	19,783,289	15,768,100	4,971,719	1,353,044	782.43	12.50	11.16

5.3. Evidence that some progress has been made lies in the fact that the proportion of treated (as opposed to untreated) waste being discharged directly into the sea has increased, although the exact extent of such increase since 1976/1977 cannot be mathematically computed, either for any country or on a global regional basis. The same can be said regarding the construction of submarine outfall structures, which are known to have increased in number since 1976/1977 from sources other than the questionnaires, and which therefore result in more of the waste being discharged a variable distance out to sea, thereby decreasing coastal pollution by domestic sewage. What is, however, evident is that, in several countries, from the data received and summarised in this document, a large proportion of domestic sewage is still being discharged directly into the sea either untreated or only partially treated.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. From the results obtained from the survey so far, no meaningful evaluation can be made, except for partial evaluations of the situation existing in a number of individual countries, which is outside the scope of this document. More complete information, consisting of (a) provision of further data from those countries which have submitted partially-completed questionnaires, and (b) provision of complete data from those countries not having replied so far, would enable both a global evaluation of the existing situation to be made and, at least to some extent, a comparison with the 1976/77 situation, as data could also be geographically categorized to fit in with the sub-regional entities used in the first survey. Furthermore, in order to attempt to correlate the current situation with control measures taken in the recent past, more information on such control measures will be required from countries.

6.2. The scope of the survey, apart from providing a global picture of the existing marine pollution situation in the Mediterranean region, is also to enable individual countries to obtain basic data on their own specific situation in order to facilitate the development and implementation of the necessary prevention and control measures to best meet their specific needs.

6.3. It is recommended that:

(a) The current survey be completed as soon as possible, so that a final evaluation comprising all Mediterranean countries, *i.e.* for the whole of the region, can be made. An essential prerequisite of such completion is better cooperation from countries.

(b) A further survey on exactly the same lines, to enable direct comparison, be made after an adequate period of time,

(c) Such a survey to also take into account the recommendations of the Washington DC Conference on the preparation of the Global Plan of Action for the Protection of the Marine Environment from Land-Based Activities.

ANNEX 1

QUESTIONNAIRES UTILIZED IN THE CURRENT SURVEY

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WHO EURO Project Office
Mediterranean Action Plan



ORGANISATION MONDIALE DE LA SANTE
BUREAU REGIONAL DE L'EUROPE

Bureau du Projet OMS/EURO
Plan d'action pour la Méditerranée

ICP/CEH 064

MED/X/BIS/1

SURVEY ON POLLUTANTS FROM LAND-BASED SOURCES IN
THE MEDITERRANEAN

QUESTIONNAIRE ON LIQUID DOMESTIC DISCHARGES

Vassileos Konstantinou 48
GR 11635 Athens - Greece

Vassileos Konstantinou 48
ATHENES 501/1 - Grèce

TELEGR.:
UNITERRA Athens

TELEX:
222511 medu gr

TEL:
7244536

QUESTIONNAIRE ON LIQUID DOMESTIC DISCHARGES

1. Country: (Please attach map)
2. Region: (Please identify on map)
3. City, metropolitan area or tourist complex (Please identify on map, and give province, district and coastal zone):

.....

4. Population:

Normal population	Average Seasonal increase

Duration of tourist season (Please give relevant months):
 to

Year of reference (i.e. when last census taken):

5. Community water supply:

5.1 Normal monthly water consumption m³/month

5.2 Peak water consumption m³/month

5.3 Kind of water supply used by municipality:

(a) official sources

(b) other

5.4 Estimated percentage discrepancy between production and consumption figures (i.e. through leakages, etc.)

6. Municipal waste water:

	Treated		Untreated	
	m ³ /year	%	m ³ /year	%
6.1 Estimated annual discharge direct into the sea or a river:				
(a) Through a municipal sewer system
(b) Through other sewer systems, if any, (complementary to the municipal system
6.2 Estimated annual discharge as below (not including wastewater re-used under 6.3):				
(c) on land
(d) in sub-soil
(e) others (specify):

6.3 Estimate annual amount of wastewater re-used:				
(a) in irrigation ponds
(b) in fish ponds
(c) in industry
(d) in recreational areas
(e) in recharges
(f) Sub-total (a+b+c+d+e)
6.4 Total direct discharges (6.1 (a+b))
Total other discharges (6.2 (c+d+e))
Total re-used (6.3 (f))
GRAND TOTAL:*

* The percentages of treated and untreated waste water given in the bottom box should add up to 100%.

6.5 Estimated population served:

(a) to the municipal sewer system (see 6.1(a))	.....
(b) to other sewer systems (see 6.1(b))	.....
(c) served by other systems, e.g. cesspits, septic tanks, etc.)	.....
TOTAL: =====

7. Treatment:

7.1 Sewage treatment at the municipal sewer system:

7.1.1 Percentage of water treated:

Type of final treatment before discharge	Preliminary	Primary	Chemical	Secondary	Tertiary
Percentage of treated waste water*/

*/ If all the treated waste water undergoes one type of treatment, the relevant percentage will be 100% under the appropriate type of final treatment. If the treated waste water is not uniformly treated, the relevant percentages should be given under the appropriate type of final treatment.

7.1.2 Efficiency of treatment:

Estimated efficiency *	Preliminary	Primary	Chemical	Secondary	Tertiary
(a) Percentage of BOD removal
(b) Percentage of S.S. removal

* If the estimated data is not based on actual measured figures, please add an asterisk after the figures given, and briefly state method of estimation below:

.....

Briefly describe estimated overall efficiency of treatment plant if details under 7.1.2 cannot be given:

7.1.3 Summary description of type of final treatment before discharge

(Please give the main characteristics of the relevant treatment. Do not limit to the examples given in the text)

Pre-treatment (screening, grit removal):

.....

Primary (sedimentation, flotation):

.....

Secondary (sand filters, trickling filters, activated sludge, etc.):

.....

Tertiary (coagulation and sedimentation, adsorption, electro dialysis, etc.):

.....

7.1.4 Summary description of any type of final chemical treatment before discharge (e.g. chemical precipitation):

.....

(Please attach flow-chart description of system, indicating bypass lines clearly).

7.2 Sewage treatment at the other sewer systems, if any (complementary to the municipal system):

7.2.1 Percentage of water treated:

Type of final treatment before discharge	Preliminary	Primary	Chemical	Secondary	Tertiary
Percentage of treated waste water*

*/ If all the treated waste water undergoes one type of treatment, the relevant percentage will be 100% under the appropriate type of final treatment. If the treated waste water is not uniformly treated, the relevant percentages should be given under the appropriate type of final

7.2.2 Efficiency of treatment:

Estimated efficiency *	Preliminary	Primary	Chemical	Secondary	Tertiary
(a) Percentage of BOD removal
(b) Percentage of S.S. removal

* If the estimated data is not based on actual measured figures, please add an asterisk after the figures given, and briefly state method of estimation below:

.....
.....
.....
.....

Briefly describe estimated overall efficiency of treatment plant if details under 7.2.2 cannot be given:

.....
.....

7.2.3 Summary description of type of final treatment before discharge
(Please give the main characteristics of the relevant treatment. Do not limit to the examples given in the text)

Pre-treatment (screening, grit removal):
.....
.....

Primary (sedimentation, flotation):
.....
.....

Secondary (sand filters, trickling filters, activated sludge, etc.):
.....
.....

Tertiary (coagulation and sedimentation, adsorption, electrodialysis, etc.):
.....
.....

7.2.4 Summary description of any type of final chemical treatment before discharge (e.g. chemical precipitation):

.....

(Please attach flow-chart description of system, indicating bypass lines clearly).

7.3 Sludge treatment:

7.3.1 Quantity of sludge in m³/year:

7.3.2 Type of treatment, if any (please tick appropriate space):

- Incineration
- Composting
- Pulverisation
- Other (describe)
-
-
-

7.3.3 Final disposal (describe):

.....

8. Outfalls into the sea:

8.1 Basic characteristics of outfalls for 7.1:

Outfall	Length	Depth	Diameter	Design criteria *	Additional remarks **
1
2
.....

* give maximum and minimum dilution values
 ** provide information on number, length and size of diffusers, flows, location, currents in area and any other relevant facts

8.2 Basic characteristics of outfalls for 7.2:

Outfall	Length	Depth	Diameter	Design criteria *	Additional remarks **
1
2
.....

* give maximum and minimum dilution values

** provide information on number, length and size of diffusers, flows, location, currents in area and any other relevant facts

9. Industrial waste water:

9.1 Attach list of industries by type in the area.

9.2 Estimated total industrial waste water in the coastal metropolitan or urban area under consideration (m³/year)

9.2.1 Estimated part of industrial waste water disposed of with municipal waste water

9.2.2 Estimated part of industrial waste water disposed of by industry by own means

Treated*/		Untreated	
m ³ /year	%	m ³ /year	%
.....
.....
.....

*/ Treated by the industry itself, not municipal.

9.3 Year in which data above was obtained:

10. Municipal solid wastes

10.1 Estimated annual municipal solid wastes

Total waste	Method of disposal					
	incineration		composting		other	
Ktons/year	Ktons/yr	%	Ktons/yr	%	Ktons/yr	%
.....

Treated		Untreated	
ktons/yr	%	ktons/yr	%
.....

10.2 Estimated total annual municipal solid wastes disposed into the sea or a river

10.3 Describe briefly the type of treatment, if any, for solid wastes under 10.1 and 10.2 above:

.....

10.4 Details of sanitary landfills

Landfill	Distance from coast	Volume (m ³)	Mean moisture content	nature of substratum*
1
2
.....

* State whether permeable or non-permeable.

10.5 Year in which data above was obtained:

11. Physical, chemical and organic parameters of municipal waste water effluents

This part of the questionnaire should be filled in as completely as possible, giving average values of the pollutants listed which are discharged in the effluents of municipal wastewater. For the purpose of this questionnaire, a mixed effluent, i.e. an effluent containing both domestic and industrial wastewater is also included if discharged through a municipal system.

In the case of additional pollutants (not listed) of importance due to special local conditions, please include these at the end of the list at para 11.2.7, completing the relevant boxes.

In the boxes:

Max. is the maximum value obtained in the reference year.

Min. is the minimum value obtained in the reference year.

Average is the arithmetical mean value based on a number of samples taken during a sampling period within the reference year.

Year is the reference year - i.e. the year in which the values were obtained.

Sampling frequency: write interval (i.e. monthly, fortnightly, etc.) or number of samplings per year.

Method of analysis: write descriptive name of method (i.e. MF for membrane filtration, GC for Gas Chromatography, AAS for Atomic Absorption Spectrophotometry, etc.)

If exact measurements and precise analyses are not available, give any valuable approximate figures, and add asterisks after them.

	Max.	Min.	Ave- rage	Year	Sampling frequency	Method of analysis
11.1 Volume/day (m ³ /day)
11.2 <u>Significant pollutants:</u>						
11.2.1 <u>Organic matter:</u>						
BOD mg/L
COD mg/L
TOC mg/L

	Max.	Min.	Ave- rage	Year	Sampling frequency	Method of analysis
11.2.2 <u>Phosphorus and nitrogen:</u>						
Total phosphorus mg/L
Total kjeldahl nitrogen mg/L
Nitrates mg/L
Ammonia mg/L
Total inorganic nitrogen (mg/L)
11.2.3 <u>Microbiological parameters:</u>						
Faecal coliforms (col/100 ml)
Faecal streptococci (col/100 ml)
Others (specify):						
.....
.....
.....
11.2.4 <u>Various:</u>						
Suspended solids						
(a) Total suspended solids (TSS, mg/L)
(b) Volatile suspended solids (VSS, mg/L)
Temperature
11.2.5 <u>Heavy metals:</u>						
Mercury (Hg, ug/L)
Cadmium (Cd, ug/L)

11.2.6 Organic substances:

Chlorinated organic compounds with the exception of PCB (ug/L)

Polychlorinated biphenyls (PCB ug/L)

11.2.7 Other pollutants of importance
(list below):

.....
.....
.....

	Max.	Min.	Ave- rage	Year	Sampling frequency	Method of analysis
Chlorinated organic compounds with the exception of PCB (ug/L)
Polychlorinated biphenyls (PCB ug/L)
.....
.....
.....

12. Administrative data:

12.1 Name of person compiling reply to questionnaire:

.....

12.2 Affiliation and address:

.....
.....
.....
.....

12.3 Date:

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WHO EURO Project Office
Mediterranean Action Plan



ORGANISATION MONDIALE DE LA SANTE
BUREAU REGIONAL DE L'EUROPE

Bureau du Projet OMS/EURO
Plan d'action pour la Méditerranée

ICP/CEH 064

MED/X/BIS/2

**SURVEY ON POLLUTANTS FROM LAND-BASED SOURCES IN
THE MEDITERRANEAN**

**QUESTIONNAIRE ON INDUSTRIAL DISCHARGES CONTAINING SELECTED
SUBSTANCES LISTED IN ANNEXES I AND II TO THE PROTOCOL
FOR PROTECTION OF THE MEDITERRANEAN SEA AGAINST
POLLUTION FROM LAND-BASED SOURCES**

QUESTIONNAIRE ON INDUSTRIAL DISCHARGES CONTAINING SELECTED
SUBSTANCES LISTED IN ANNEXES I AND II TO THE PROTOCOL
FOR PROTECTION OF THE MEDITERRANEAN SEA AGAINST
POLLUTION FROM LAND-BASED SOURCES

1. Country: (Please provide map)
2. Region: (Please identify on map)
3. City or industrial area: (Please identify on map)
4. Classification (please tick appropriate space):

"Individual industry" (4.1) refers to a single operational industry constituting an isolated source of discharge, and discharging substances listed in Annexes I and II to the protocol for protection of the Mediterranean Sea against pollution from land-based sources, particularly substances listed in section 6.3 of this questionnaire. "Group of similar industries" (4.2) refers to several industries of the same or similar type grouped together, using one or more points of discharge. "Industrial zone" (4.3) refers to areas with industries of different types, productions and technologies, but geographically grouped together. This questionnaire cannot be applied to industrial zones with several wastewater systems, discharging separately at different points, unless the zone is split into single contributories, and a separate questionnaire has to be used for each such part of the industrial zone.

- 4.1 Individual industry
- 4.2 Group of similar industries
- 4.3 Industrial zone
- 4.4 Urban area with industries

5. Type(s) of industry

Indicate the type(s) of industry in accordance with the list in Annex I. To facilitate your reply use the corresponding figures (e.g. 22 for pulp and paper). If the list in Annex I does not adequately specify the type of industry, your additional comments and explanations would be appreciated, using lines 57-62 of Annex I.

.....

6. Wastewater discharge and treatment:

- 6.1 Discharge site
- geographical position
-

- other information (in the case of pipelines, depth of water and distance from coast

- outfalls into the sea:

Outfall	Length	Depth	Diameter	Design criteria *	Additional remarks **
1
2
.....

* give maximum and minimum dilution values

** provide information on number, length and size of diffusers, flows, location, currents in area and any other relevant facts

6.2 Type of wastewater and way of discharge:

"Process wastewater" refers to any kind of wastewater released from any type of technological process of the industrial production. If it is discharged into a single sewer with cooling water and/or domestic sewage, please strike out the word "Process" from the term "Process wastewater" in the table, and put in overall figures in the appropriate columns.

Under "type of treatment" please enter the code number in Annex II referring to the procedure or technology used. If the type of treatment used is not listed in Annex II, please add it in the annex itself using the extra spaces provided, and complete the table accordingly. Where more than one type of technological process is being applied for wastewater treatment, please use a combination of numbers (e.g. 1+5+10). If a treatment plant is under design or construction, please fill in the columns regarding "type of treatment" and add an asterisk (e.g. 1*).

Under "point of discharge":

- (a) the amount of wastewater being discharged into any municipal system, irrespective of its further treatment or discharge, should be stated;
- (b) "by outfall" refers to sewer outfalls to the sea discharging the wastewater far offshore. Outfalls discharging on or near the coastline are considered as "on shore" discharge points;

Domestic sewage means that originating from the industry or industries in question. Discharges into municipal systems should be classified as treated only if such treatment is carried out prior to reaching the point of discharge into such systems.

6.3 Wastewater quality at point of discharge:

In the following table:

"Average value" refers to the arithmetical mean value based on the number of samples given in the next column. "Sampling" refers to the frequency of sampling to be given either as the interval between successive samplings (i.e. quarterly, monthly, etc.) if sampling is regular, or as number of samplings per year. "Year of reference" refers to the calendar year in which the data have been obtained.

Pollutants	Unit	Average value	Number of samples	Sampling	Year of reference
Arsenic (As)	ug/l	.....	.....	.....	.....
Mercury (Hg)	ug/l	.....	.....	.....	.....
Lead (pb)	ug/l	.....	.....	.....	.....
Cadmium (Cd)	ug/l	.....	.....	.....	.....
Copper (Cu)	mg/l	.....	.....	.....	.....
Chrome (Cr)	mg/l	.....	.....	.....	.....
Nickel (Ni)	mg/l	.....	.....	.....	.....
Zinc (Zn)	mg/l	.....	.....	.....	.....
Other metals:		.....	.....	.....	.....
.....
.....
.....
.....
Phenols	mg/l	.....	.....	.....	.....
Organophosphorus compounds	ug/l	.....	.....	.....	.....
Organochlorine compounds (except PCBs)	ug/l	.....	.....	.....	.....
Polychlorinated biphenyls	ug/l	.....	.....	.....	.....
Other organic compounds:		.....	.....	.....	.....
.....
.....
.....
.....
Total phosphorus	mg/l	.....	.....	.....	.....
Total Kjeldahl nitrogen	mg/l	.....	.....	.....	.....
Other nutrients:		.....	.....	.....	.....
.....
.....
.....
.....

6.4 Period of discharge (Specify whether discharge is continuous throughout the year or, if not, in which period it occurs):

.....

6.5 Description of wastewater treatment facilities in operation:

Please attach separate sheet, giving an explanation of any existing and operational treatment plant, including an appropriate flow-chart clearly indicating bypass lines.

7. Sludge and/or solid waste treatment and disposal:

In the following table:

Entries in the column "point of disposal" mean the same as those under "point of discharge" in 6.2 above. Under "amount", give the amount of sludge and/or solid waste being disposed of immediately (or after treatment if a treatment plant is in operation). Give figures in terms of either volume (m³/y) or weight (t/y), depending on the nature of the medium (liquid or solid). Under "% moist" give moisture content of solid media as a percentage of weight (in order to facilitate a further calculation of dry matter content).

Under "type of treatment", if any treatment facilities are operational before the point of discharge, please enter the code number in Annex III referring to the particular treatment process used. If the type of treatment used is not listed, please add it, using the extra spaces provided, and complete the table accordingly. Where more than one type of technological process is applied, please use a combination of numbers (e.g. 1+5). If any treatment plant is under design or construction, please add an asterisk after the number relating to the type of treatment.

Point of disposal	Unit	Sludge			Solid waste			Sludge + solid waste		
		Amount	% moist	Type of treatment	Amount	% moist	Type of treatment	Amount	% moist	Type of treatment
Municipal system	m ³ /yr	.....			.....			.....
	t/yr	.....			.....			.....
On land	m ³ /yr	.....			.....			.....
	t/yr	.....			.....			.....
On shore	m ³ /yr	.....			.....			.....
	t/yr	.....			.....			.....
Offshore by dumping	m ³ /yr	.....			.....			.....
	t/yr	.....			.....			.....
TOTAL	m ³ /yr	.....			.....			.....
	t/yr	.....			.....			.....

9.2 Raw materials in use:

Type of raw material	Unit	Annual consumption	Year of reference	Operational period
a	b	c	d	e
.....
.....
.....
.....
.....
.....

9.3 Total number of employees:

Year of reference:

9.4 Age of plant: (Give year of commencement of operations)

9.5 Estimated pollution load:

In the following table, please provide any approximate estimates available of the pollution load, based on the information given in tables 9.1 and 9.2. Please indicate on a separate sheet the way in which such estimate was arrived at.

Pollution being discharged into receiving waters	mg/l	tons/year
.....
.....
.....
.....
.....
.....
.....

10. Administrative data:

10.1 Name of person responsible for reply to questionnaire:

.....

10.2 Affiliation and address:

.....
.....
.....
.....

10.3 Date:

ANNEX I

CLASSIFICATION OF INDUSTRIES a/

- | | |
|---|---------------------------------|
| 1. Agriculture and livestock (1110) | 30. Phosphates (3511) |
| 2. Feedlot (1110) | 31. Wood preservation (3511) |
| 3. Coal mining and preparation (2110) | 32. Fertiliser (3512) |
| 4. Oil mining (2200) | 33. Pesticide (3512) |
| 5. Mineral mining (2302) | 34. Plastic and resins (3513) |
| 6. Stone quarrying, clay and sand pits (2907) | 35. Paints (3521) |
| 7. Meak packing (3111) | 36. Animal glue (3523) |
| 8. Cannery (3112) | 37. Soap and detergents (3523) |
| 9. Fish (3114) | 38. Candle (3529) |
| 10. Bakery (3117) | 39. Cornstarch (3523) |
| 11. Beet sugar (3118) | 40. Photographic wastes (3529) |
| 12. Cane sugar (3119) | 41. Oil refinery (3530) |
| 13. Coffee (3121) | 42. Coke mill (3540) |
| 14. Pickle (3121) | 43. Fuel oil (3540) |
| 15. Rice (3121) | 44. Petrochemicals (3540) |
| 16. Brewery, distillery, pharmaceutical (3131-3133) | 45. Rubber (3551) |
| 17. Soft drinks (3134) | 46. Glass (3620) |
| 18. Textile (3211) | 47. Cement (3692) |
| 19. Tannery (3231) | 48. Asbestos* (3699) |
| 20. Plywood glue plant (3311) | 49. Steel mill (3710) |
| 21. Wood furniture (3320) | 50. Iron foundry (3720) |
| 22. Pulp and paper (3411) | 51. Other metal (3720) |
| 23. Building paper (3412) | 52. Metal plating wastes (3819) |
| 24. Printing (3420) | 53. Motor industry (3821) |
| 25. Acid (3511) | 54. Steam power (4103) |
| 26. Explosives (3511) | 55. Water treatment (4200) |
| 27. Formaldehyde (3511) | 56. Laundry (9520) |
| 28. Naval stores (3511) | 57. |
| 29. Other organic chemicals (3511) | 58. |
| | 59. |
| | 60. |
| | 61. |
| | 62. |

a/ This classification is based on "Indexes to the International Standard Industrial Classification of All Economic Activities" statistical papers, Series M. No.4, Rev.2, Add.1. Department of Economic and Social Affairs, Statistical Office of the United Nations, New York 1971 (United Nations publication, Sales No. E.71.XVII.8), to which the numbers in brackets refer.

ANNEX II

TYPE OF WASTEWATER TREATMENT PROCESS

- | | | | |
|-----|----------------------------|-----|--------------------------------|
| 0. | No treatment | 13. | Spray irrigation |
| 1. | Screening | 14. | Anaerobic digestion |
| 2. | Grit removal | 15. | Evaporation, flash evaporation |
| 3. | Chemical coagulation | 16. | Dialysis, electro-dialysis |
| 4. | Chemical precipitation | 17. | Ion exchange |
| 5. | Primary sedimentation | 18. | Ultra- and hyper-filtration |
| 6. | Flotation | 19. | Sand filtration |
| 7. | Foam separation | 20. | Reverse osmosis |
| 8. | Grease removal | 21. | Adsorption |
| 9. | Lagooning | 22. | Disinfection |
| 10. | Activated sludge treatment | 23. | Cooling |
| 11. | Trickling filtration | 24. | Equalisation |
| 12. | Secondary sedimentation | | |

Other process

- | | | | |
|-----|-------|-----|-------|
| 25. | ..... | 27. | ..... |
| 26. | ..... | 28. | ..... |

ANNEX III

TYPE OF SOLID WASTE/SLUDGE TREATMENT PROCESS

- | | | | |
|----|---------------------|-----|-------------------|
| 0. | No treatment | 7. | Drying beds |
| 1. | Thickening | 8. | Lagooning |
| 2. | Aerobic digestion | 9. | Incineration |
| 3. | Anaerobic digestion | 10. | Composting |
| 4. | Vacuum filtration | 11. | Sanitary landfill |
| 5. | Centrifuge | 12. | Disinfection |
| 6. | Filter press | | |

Other process

- | | |
|-----|-------|
| 13. | ..... |
| 14. | ..... |
| 15. | ..... |
| 16. | ..... |
| 17. | ..... |

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WHO EURO Project Office
Mediterranean Action Plan



ORGANISATION MONDIALE DE LA SANTE
BUREAU REGIONAL DE L'EUROPE

Bureau du Projet OMS/EURO
Plan d'action pour la Méditerranée

ICP/CEH 064

MED/X/BIS/3(a)

**SURVEY ON POLLUTANTS FROM LAND-BASED SOURCES IN
THE MEDITERRANEAN**

**QUESTIONNAIRE ON INDUSTRIAL DISCHARGES OF PETROLEUM
HYDROCARBONS**

QUESTIONNAIRE ON INDUSTRIAL DISCHARGES
OF PETROLEUM HYDROCARBONS

1. Country: (Please provide map)
2. Region: (Please identify on map)
3. Direct discharges of petroleum hydrocarbons

<u>Origin</u>	<u>Amount discharged</u> <u>in metric tons/year</u>	<u>Year of</u> <u>reference</u>
3.1 Coastal discharges (including municipal wastes from coastal areas)
3.2 Coastal refineries
3.3 Reception facilities
3.4 Oil terminals
3.5 Platforms (exploration and exploitation)
3.6 Others (please specify)		
.....
.....
.....
3.7 Total direct discharges

4. Indirect discharges of petroleum hydrocarbons

<u>Origin</u>	<u>Amount discharged</u> <u>in metric tons/year</u>	<u>Year of</u> <u>reference</u>
4.1 Run-off from land (including inland municipal waste)
4.2 Inland refineries
4.3 Others (please specify)		
.....
.....
.....
4.4 Total indirect discharges

5. Total discharges (from 3 and 4 above)

Amount discharged
in metric tons/year

5.1 Grand total

6. Administrative data

6.1 Name of person responsible for reply to questionnaire:

.....

6.2 Affiliation and address:

.....

.....

.....

.....

6.3 Date:

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE

WHO EURO Project Office
Mediterranean Action Plan



ORGANISATION MONDIALE DE LA SANTE
BUREAU REGIONAL DE L'EUROPE

Bureau du Projet OMS/EURO
Plan d'action pour la Méditerranée

ICP/CEH 064

MED/X/BIS/3(b)

SURVEY ON POLLUTANTS FROM LAND-BASED SOURCES IN
THE MEDITERRANEAN

QUESTIONNAIRE ON OIL DISCHARGES FROM REFINERIES

QUESTIONNAIRE ON OIL DISCHARGES FROM REFINERIES

- 1. Country: (Please provide map)
- 2. Region: (Please identify on map)
- 3. City or industrial area: (Please identify on map)
- 4. Name or other identification of refinery: (Please provide details)

.....

5. Nature of refinery (please tick appropriate space):

- 5.1 Type I Simple refinery : composed of crude oil distillation units, catalytic reforming units and facilities for the treatment of distillate products including desulphurisation
- 5.2 Type II Type I plus catalytic cracking and/or thermal cracking and/or hydrocracking
- 5.3 Type III Type II plus steam cracking in refineries only and/or production of lubricants within refinery fence

6. Total volume of feedstock processed in year of reference:

..... metric tons
of which: crude oil feedstock metric tons
 other feedstock metric tons

7. Primary oil refining capacity in year of reference:

..... metric tons

8. Nature of cooling system (please tick appropriate space):

- 8.1 Air
- 8.2 Water (once through system) open circuit
 closed circuit
- Please state recirculation rate:
- 8.3 Water (recycled cooling water system)

9. Discharge, treatment and analysis:

	Type of discharge	Cooling water	Process water	Ballast water	Storm and other surface water runoff	Total
9.1	Flow of discharge: tonnes/year	<input checked="" type="checkbox"/>
9.2	Type of treatment: (tick where applicable)					<input checked="" type="checkbox"/>
	Gravity separation	<input checked="" type="checkbox"/>
	Advanced separation	<input checked="" type="checkbox"/>
	Biotreatment	<input checked="" type="checkbox"/>
9.3	Hydrocarbon concentration at exit of treatment system (mg/L)	<input checked="" type="checkbox"/>
9.4	Analytical method used to estimate hydrocarbon concentration: (Complete where applicable)					<input checked="" type="checkbox"/>
	<u>Infra red</u>					
	Extraction solvent	.....	.....	.....	.....
	Standard solution	.....	.....	.....	.....
	I.R. Wave-lengths used	.....	.....	.....	.....
	<u>Gravimetric</u>	.....	.....	.....	.....
	(Tick where applicable)					
	<u>Gas chromatography</u>	.....	.....	.....	.....
	(Tick where applicable)					
9.5	Quantity of hydrocarbons discharged:					
	Tonnes/year	.....	.....	.....	.....

9.6 Ratio of hydrocarbons discharged/
feedstock processed tons/10⁶ tons

9.7 Ratio of hydrocarbons discharged/
oil refinery capacity tons/10⁶ tons

10. Data on concentration of other parameters:

Type of discharge	Cooling water	Process water	Ballast water	Storm and other surface water runoff	Total quantities (t/yr)
<u>Parameters:</u>					
10.1 COD
10.2 BOD
10.3 Phenolic compounds
10.4 Sulphides (including mercaptans)

11. Whether or not process waters are mixed with cooling waters before treatment: (Please tick appropriate space)

YES NO

12. If possible, attach a simple flow diagram of refinery effluent systems, showing:

- 12.1 Flow rates for the various streams in m³/hour
- 12.2 Location of treatment plant
- 12.3 Location of sampling points
- 12.4 Bypass lines, if any

13. Environmental monitoring in vicinity of discharge sites:

13.1 Existence of monitoring programme: (Please tick appropriate space)

YES NO

13.2 Is monitoring performed under the terms of any law?: (Please tick appropriate space)

YES NO

13.3 Name of organisation responsible for monitoring:

.....

13.4 Matrices monitored (please tick)

- water
- sediments
- marine organisms

13.5 Parameters monitored: (Please list chemical and microbiological parameters in first column and tick appropriate spaces in other columns)

<u>Parameter</u>	<u>Water</u>	<u>Sediments</u>	<u>Organisms</u>
.....
.....
.....
.....
.....

13.4 Sampling frequency:

13.5 Availability of monitoring data:

YES NO

14. Type of receiving area into which refinery discharges (please tick appropriate space):

14.1 Coastal waters

14.2 River or other internal waterway

14.3 Sewer

15. Year of reference for which reply to questionnaire has been compiled:

16. Administrative data:

16.1 Name of person responsible for reply to questionnaire:

.....

16.2 Affiliation and address:

.....

.....

.....

.....

16.3 Date:

WORLD HEALTH ORGANIZATION
REGIONAL OFFICE FOR EUROPE



ORGANISATION MONDIALE DE LA SANTE
BUREAU REGIONAL DE L'EUROPE

WHO EURO Project Office
Mediterranean Action Plan

Bureau du Projet OMS/EURO
Plan d'action pour la Méditerranée

ICP/CEH 064

MED/X/BIS/3(c)

SURVEY ON POLLUTANTS FROM LAND-BASED SOURCES IN
THE MEDITERRANEAN

QUESTIONNAIRE ON OIL DISCHARGES FROM RECEPTION FACILITIES

QUESTIONNAIRE ON OIL DISCHARGES FROM
RECEPTION FACILITIES

1. Country:
2. Region: (Please identify on map)
3. City or industrial area: (Please identify on map)
4. Name or other identification of reception facility:
.....
5. Nature of reception facility (please tick appropriate space):
 - 5.1 Refinery
 - 5.2 Port or harbour
 - 5.3 Pipeline terminal
 - 5.4 Tank farm/Distribution Centre
 - 5.5 Other
6. Proportion of the year in which there is an oily water discharge from the reception facility: (Please express as percentage of whole year, calculating from number of days per year)%
7. Nature of discharge:
 - 7.1 Average flow during period of discharge m³/(indicate unit of time)
 - 7.2 Average flow during year m³/(indicate unit of time).
 - 7.3 Maximum flow m³/(indicate unit of time)
 - 7.4 Whether or not flow is restricted by physical means (e.g. pump rates/orifices, etc.) (Please tick appropriate space) YES NO
 - 7.5 Average oil concentration during discharge mg oil/litre
 - 7.6 Maximum oil concentration during discharge mg oil/litre
 - 7.7 Quantity of oil discharged in metric tons of pollutant per year mt/year

8. Type of discharge treatment (please tick appropriate space):

- 8.1 Physical, e.g. API, CPl, tank
- 8.2 Chemical/physical, e.g. chemical addition, air flotation, sedimentation, filtration
- 8.3 Biochemical, e.g. trickling filter, activated sludge, aerate pond
- 8.4 No treatment

9. Analytical method used to estimate oil concentration (please tick appropriate space):

- 9.1 Infra red
- 9.2 Gravimetric
- 9.3 Solvent
- 9.4 I.R. wavelength
- 9.5 Calibration standard

10. Representative status of oil discharge during year of reference (please tick appropriate space):

- 10.1 Relatively high
- 10.2 Fairly representative of normal operation
- 10.3 Relatively low

11. If status unrepresentative of normal operations (10.1 or 10.3), estimate of normal discharge at average concentration:

..... metric tons effluent/year

12. Fate of oil recovered at reception facility:

12.1 Re-use (please describe briefly):

.....
.....
.....

12.2 Disposal (please describe briefly):

.....
.....
.....

13. Discharge of treated effluent (please tick appropriate space):

13.1 To sewer for further treatment

13.2 To estuary or river

13.3 To coastal waters

14. Responsibility for treatment, if any: (Please tick appropriate space)

Industry

Municipality

Other (describe)

.....

15. Is any treatment plant under construction or planned?: (Please describe briefly)

.....

.....

16. Environmental monitoring in vicinity of discharge sites:

16.1 Existence of monitoring programme: (Please tick appropriate space)

YES NO

16.2 Is monitoring performed under the terms of any law?: (Please tick appropriate space)

YES NO

16.3 Name of organisation responsible for monitoring:

.....

16.4 Matrices monitored (please tick)

- water

- sediments

- marine organisms

16.5 Parameters monitored: (Please list chemical and microbiological parameters in first column and tick appropriate spaces in other columns)

<u>Parameter</u>	<u>Water</u>	<u>Sediments</u>	<u>Organisms</u>
.....
.....
.....
.....
.....

16.4 Sampling frequency:

16.5 Availability of monitoring data:

YES NO

17. Calendar year for which above information compiled:

18. Administrative data:

18.1 Name of person responsible for reply to questionnaire:

.....

18.2 Affiliation and address:

.....

.....

.....

.....

18.3 Date:

PUBLICATIONS OF THE MAP TECHNICAL REPORTS SERIES

1. UNEP/IOC/WMO: Baseline studies and monitoring of oil and petroleum hydrocarbons in marine waters (MED POL I). MAP Technical Reports Series No. 1. UNEP, Athens, 1986 (96 pages) (parts in English, French or Spanish only).
2. UNEP/FAO: Baseline studies and monitoring of metals, particularly mercury and cadmium, in marine organisms (MED POL II). MAP Technical Reports Series No. 2. UNEP, Athens, 1986 (220 pages) (parts in English, French or Spanish only).
3. UNEP/FAO: Baseline studies and monitoring of DDT, PCBs and other chlorinated hydrocarbons in marine organisms (MED POL III). MAP Technical Reports Series No. 3. UNEP, Athens, 1986 (128 pages) (parts in English, French or Spanish only).
4. UNEP/FAO: Research on the effects of pollutants on marine organisms and their populations (MED POL IV). MAP Technical Reports Series No. 4. UNEP, Athens, 1986 (118 pages) (parts in English, French or Spanish only).
5. UNEP/FAO: Research on the effects of pollutants on marine communities and ecosystems (MED POL V). MAP Technical Reports Series No. 5. UNEP, Athens, 1986 (146 pages) (parts in English or French only).
6. UNEP/IOC: Problems of coastal transport of pollutants (MED POL VI). MAP Technical Reports Series No. 6. UNEP, Athens, 1986 (100 pages) (English only).
7. UNEP/WHO: Coastal water quality control (MED POL VII). MAP Technical Reports Series No. 7. UNEP, Athens, 1986 (426 pages) (parts in English or French only).
8. UNEP/IAEA/IOC: Biogeochemical studies of selected pollutants in the open waters of the Mediterranean (MED POL VIII). MAP Technical Reports Series No. 8. UNEP, Athens, 1986 (42 pages) (parts in English or French only).
8. Add. UNEP: Biogeochemical studies of selected pollutants in the open waters of the Mediterranean (MED POL VIII). Addendum, Greek Oceanographic Cruise 1980. MAP Technical Reports Series No. 8, Addendum. UNEP, Athens, 1986 (66 pages) (English only).
9. UNEP: Co-ordinated Mediterranean pollution monitoring and research programme (MED POL - PHASE I). Final report, 1975-1980. MAP Technical Reports Series No. 9. UNEP, Athens, 1986 (276 pages) (English only).
10. UNEP: Research on the toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity of selected substances (Activity G). Final reports on projects dealing with toxicity (1983-85). MAP Technical Reports Series No. 10. UNEP, Athens, 1987 (118 pages) (English only).
11. UNEP: Rehabilitation and reconstruction of Mediterranean historic settlements. Documents produced in the first stage of the Priority Action (1984-1985). MAP Technical Reports Series No. 11. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1986 (158 pages) (parts in English or French only).
12. UNEP: Water resources development of small Mediterranean islands and isolated coastal areas. Documents produced in the first stage of the Priority Action (1984-1985). MAP Technical Reports Series No. 12. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1987 (162 pages) (parts in English or French only).

13. UNEP: Specific topics related to water resources development of large Mediterranean islands. Documents produced in the second phase of the Priority Action (1985-1986). MAP Technical Reports Series No. 13. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1987 (162 pages) (parts in English or French only).
14. UNEP: Experience of Mediterranean historic towns in the integrated process of rehabilitation of urban and architectural heritage. Documents produced in the second phase of the Priority Action (1986). MAP Technical Reports Series No. 14. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1987 (500 pages) (parts in English or French only).
15. UNEP: Environmental aspects of aquaculture development in the Mediterranean region. Documents produced in the period 1985-1987. MAP Technical Reports Series No. 15. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1987 (101 pages) (English only).
16. UNEP: Promotion of soil protection as an essential component of environmental protection in Mediterranean coastal zones. Selected documents (1985-1987). MAP Technical Reports Series No. 16. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1987 (424 pages) (parts in English or French only).
17. UNEP: Seismic risk reduction in the Mediterranean region. Selected studies and documents (1985-1987). MAP Technical Reports Series No. 17. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1987 (247 pages) (parts in English or French only).
18. UNEP/FAO/WHO: Assessment of the state of pollution of the Mediterranean Sea by mercury and mercury compounds. MAP Technical Reports Series No. 18. UNEP, Athens, 1987 (354 pages) (English and French).
19. UNEP/IOC: Assessment of the state of pollution of the Mediterranean Sea by petroleum hydrocarbons. MAP Technical Reports Series No. 19. UNEP, Athens, 1988 (130 pages) (English and French).
20. UNEP/WHO: Epidemiological studies related to environmental quality criteria for bathing waters, shellfish-growing waters and edible marine organisms (Activity D). Final report on project on relationship between microbial quality of coastal seawater and health effects (1983-86). MAP Technical Reports Series No. 20. UNEP, Athens, 1988 (156 pages) (English only).
21. UNEP/UNESCO/FAO: Eutrophication in the Mediterranean Sea: Receiving capacity and monitoring of long-term effects. MAP Technical Reports Series No. 21. UNEP, Athens, 1988 (200 pages) (parts in English or French only).
22. UNEP/FAO: Study of ecosystem modifications in areas influenced by pollutants (Activity I). MAP Technical Reports Series No. 22. UNEP, Athens, 1988 (146 pages) (parts in English or French only).
23. UNEP: National monitoring programme of Yugoslavia, Report for 1983-1986. MAP Technical Reports Series No. 23. UNEP, Athens, 1988 (223 pages) (English only).
24. UNEP/FAO: Toxicity, persistence and bioaccumulation of selected substances to marine organisms (Activity G). MAP Technical Reports Series No. 24. UNEP, Athens, 1988 (122 pages) (parts in English or French only).
25. UNEP: The Mediterranean Action Plan in a functional perspective: A quest for law and policy. MAP Technical Reports Series No. 25. UNEP, Athens, 1988 (105 pages) (English only).
26. UNEP/IUCN: Directory of marine and coastal protected areas in the Mediterranean Region. Part I - Sites of biological and ecological value. MAP Technical Reports Series No. 26. UNEP, Athens, 1989 (196 pages) (English only).

27. UNEP: Implications of expected climate changes in the Mediterranean Region: An overview. MAP Technical Reports Series No. 27. UNEP, Athens, 1989 (52 pages) (English only).
28. UNEP: State of the Mediterranean marine environment. MAP Technical Reports Series No. 28. UNEP, Athens, 1989 (225 pages) (English only).
29. UNEP: Bibliography on effects of climatic change and related topics. MAP Technical Reports Series No. 29. UNEP, Athens, 1989 (143 pages) (English only).
30. UNEP: Meteorological and climatological data from surface and upper measurements for the assessment of atmospheric transport and deposition of pollutants in the Mediterranean Basin: A review. MAP Technical Reports Series No. 30. UNEP, Athens, 1989 (137 pages) (English only).
31. UNEP/WMO: Airborne pollution of the Mediterranean Sea. Report and proceedings of a WMO/UNEP Workshop. MAP Technical Reports Series No. 31. UNEP, Athens, 1989 (247 pages) (parts in English or French only).
32. UNEP/FAO: Biogeochemical cycles of specific pollutants (Activity K). MAP Technical Reports Series No. 32. UNEP, Athens, 1989 (139 pages) (parts in English or French only).
33. UNEP/FAO/WHO/IAEA: Assessment of organotin compounds as marine pollutants in the Mediterranean. MAP Technical Reports Series No. 33. UNEP, Athens, 1989 (185 pages) (English and French).
34. UNEP/FAO/WHO: Assessment of the state of pollution of the Mediterranean Sea by cadmium and cadmium compounds. MAP Technical Reports Series No. 34. UNEP, Athens, 1989 (175 pages) (English and French).
35. UNEP: Bibliography on marine pollution by organotin compounds. MAP Technical Reports Series No. 35. UNEP, Athens, 1989 (92 pages) (English only).
36. UNEP/IUCN: Directory of marine and coastal protected areas in the Mediterranean region. Part I - Sites of biological and ecological value. MAP Technical Reports Series No. 36. UNEP, Athens, 1990 (198 pages) (French only).
37. UNEP/FAO: Final reports on research projects dealing with eutrophication and plankton blooms (Activity H). MAP Technical Reports Series No. 37. UNEP, Athens, 1990 (74 pages) (parts in English or French only).
38. UNEP: Common measures adopted by the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against pollution. MAP Technical Reports Series No. 38. UNEP, Athens, 1990 (100 pages) (English, French, Spanish and Arabic).
39. UNEP/FAO/WHO/IAEA: Assessment of the state of pollution of the Mediterranean Sea by organohalogen compounds. MAP Technical Reports Series No. 39. UNEP, Athens, 1990 (224 pages) (English and French).
40. UNEP/FAO: Final reports on research projects (Activities H,I and J). MAP Technical Reports Series No. 40. UNEP, Athens, 1990 (125 pages) (English and French).
41. UNEP: Wastewater reuse for irrigation in the Mediterranean region. MAP Technical Reports Series No. 41. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1990 (330 pages) (English and French).
42. UNEP/IUCN: Report on the status of Mediterranean marine turtles. MAP Technical Reports Series No. 42. UNEP, Athens, 1990 (204 pages) (English and French).

43. UNEP/IUCN/GIS Posidonia: Red Book "Gérard Vuignier", marine plants, populations and landscapes threatened in the Mediterranean. MAP Technical Reports Series No. 43. UNEP, Athens, 1990 (250 pages) (French only).
44. UNEP: Bibliography on aquatic pollution by organophosphorus compounds. MAP Technical Reports Series No. 44. UNEP, Athens, 1990 (98 pages) (English only).
45. UNEP/IAEA: Transport of pollutants by sedimentation: Collected papers from the first Mediterranean Workshop (Villefranche-sur-Mer, France, 10-12 December 1987). MAP Technical Reports Series No. 45. UNEP, Athens, 1990 (302 pages) (English only).
46. UNEP/WHO: Epidemiological studies related to environmental quality criteria for bathing waters, shellfish-growing waters and edible marine organisms (Activity D). Final report on project on relationship between microbial quality of coastal seawater and rotavirus-induced gastroenteritis among bathers (1986-88). MAP Technical Reports Series No.46, UNEP, Athens, 1991 (64 pages) (English only).
47. UNEP: Jellyfish blooms in the Mediterranean. Proceedings of the II workshop on jellyfish in the Mediterranean Sea. MAP Technical Reports Series No.47. UNEP, Athens, 1991 (320 pages) (parts in English or French only).
48. UNEP/FAO: Final reports on research projects (Activity G). MAP Technical Reports Series No. 48. UNEP, Athens, 1991 (126 pages) (parts in English or French only).
49. UNEP/WHO: Biogeochemical cycles of specific pollutants. Survival of pathogens. Final reports on research projects (Activity K). MAP Technical Reports Series No. 49. UNEP, Athens, 1991 (71 pages) (parts in English or French only).
50. UNEP: Bibliography on marine litter. MAP Technical Reports Series No. 50. UNEP, Athens, 1991 (62 pages) (English only).
51. UNEP/FAO: Final reports on research projects dealing with mercury, toxicity and analytical techniques. MAP Technical Reports Series No. 51. UNEP, Athens, 1991 (166 pages) (parts in English or French only).
52. UNEP/FAO: Final reports on research projects dealing with bioaccumulation and toxicity of chemical pollutants. MAP Technical Reports Series No. 52. UNEP, Athens, 1991 (86 pages) (parts in English or French only).
53. UNEP/WHO: Epidemiological studies related to environmental quality criteria for bathing waters, shellfish-growing waters and edible marine organisms (Activity D). Final report on epidemiological study on bathers from selected beaches in Malaga, Spain (1988-1989). MAP Technical Reports Series No. 53. UNEP, Athens, 1991 (127 pages) (English only).
54. UNEP/WHO: Development and testing of sampling and analytical techniques for monitoring of marine pollutants (Activity A): Final reports on selected microbiological projects. MAP Technical Reports Series No. 54. UNEP, Athens, 1991 (83 pages) (English only).
55. UNEP/WHO: Biogeochemical cycles of specific pollutants (Activity K): Final report on project on survival of pathogenic organisms in seawater. MAP Technical Reports Series No. 55. UNEP, Athens, 1991 (95 pages) (English only).
56. UNEP/IOC/FAO: Assessment of the state of pollution of the Mediterranean Sea by persistent synthetic materials which may float, sink or remain in suspension. MAP Technical Reports Series No. 56. UNEP, Athens, 1991 (113 pages) (English and French).

57. UNEP/WHO: Research on the toxicity, persistence, bioaccumulation, carcinogenicity and mutagenicity of selected substances (Activity G): Final reports on projects dealing with carcinogenicity and mutagenicity. MAP Technical Reports Series No. 57. UNEP, Athens, 1991 (59 pages) (English only).
58. UNEP/FAO/WHO/IAEA: Assessment of the state of pollution of the Mediterranean Sea by organophosphorus compounds. MAP Technical Reports Series No. 58. UNEP, Athens, 1991 (122 pages) (English and French).
59. UNEP/FAO/IAEA: Proceedings of the FAO/UNEP/IAEA Consultation Meeting on the Accumulation and Transformation of Chemical contaminants by Biotic and Abiotic Processes in the Marine Environment (La Spezia, Italy, 24-28 September 1990), edited by G.P. Gabrielides. MAP Technical Reports Series No. 59. UNEP, Athens, 1991 (392 pages) (English only).
60. UNEP/WHO: Development and testing of sampling and analytical techniques for monitoring of marine pollutants (Activity A): Final reports on selected microbiological projects (1987-1990). MAP Technical Reports Series No. 60. UNEP, Athens, 1991 (76 pages) (parts in English or French only).
61. UNEP: Integrated Planning and Management of the Mediterranean Coastal Zones. Documents produced in the first and second stage of the Priority Action (1985-1986). MAP Technical Reports Series No. 61. UNEP, Priority Actions Programme, Regional Activity Centre, Split, 1991 (437 pages) (parts in English or French only).
62. UNEP/IAEA: Assessment of the State of Pollution of the Mediterranean Sea by Radioactive Substances. MAP Technical Reports Series No. 62, UNEP, Athens, 1992 (133 pages) (English and French).
63. UNEP/WHO: Biogeochemical cycles of specific pollutants (Activity K) - Survival of Pathogens - Final reports on Research Projects (1989-1991). MAP Technical Reports Series No. 63, UNEP, Athens, 1992 (86 pages) (French only).
64. UNEP/WMO: Airborne Pollution of the Mediterranean Sea. Report and Proceedings of the Second WMO/UNEP Workshop. MAP Technical Reports Series No. 64, UNEP, Athens, 1992 (246 pages) (English only).
65. UNEP: Directory of Mediterranean Marine Environmental Centres. MAP Technical Reports Series No. 65, UNEP, Athens, 1992 (351 pages) (English and French).
66. UNEP/CRU: Regional Changes in Climate in the Mediterranean Basin Due to Global Greenhouse Gas Warming. MAP Technical Reports Series No. 66, UNEP, Athens, 1992 (172 pages) (English only).
67. UNEP/IOC: Applicability of Remote Sensing for Survey of Water Quality Parameters in the Mediterranean. Final Report of the Research Project. MAP Technical Reports Series No. 67, UNEP, Athens, 1992 (142 pages) (English only).
68. UNEP/FAO/IOC: Evaluation of the Training Workshops on the Statistical Treatment and Interpretation of Marine Community Data. MAP Technical Reports Series No. 68. UNEP, Athens, 1992 (221 pages) (English only).
69. UNEP/FAO/IOC: Proceedings of the FAO/UNEP/IOC Workshop on the Biological Effects of Pollutants on Marine Organisms (Malta, 10-14 September 1991), edited by G.P. Gabrielides. MAP Technical Reports Series No. 69. UNEP, Athens, 1992 (287 pages) (English only).
70. UNEP/IAEA/IOC/FAO: Organohalogen Compounds in the Marine Environment: A Review. MAP Technical Reports Series No. 70. UNEP, Athens, 1992 (49 pages) (English only).

71. UNEP/FAO/IOC: Selected techniques for monitoring biological effects of pollutants in marine organisms. MAP Technical Reports Series No. 71. UNEP, Athens, 1993 (189 pages) (English only).
72. UNEP: Costs and Benefits of Measures for the Reduction of Degradation of the Environment from Land-based Sources of Pollution in Coastal Areas. A - Case Study of the Bay of Izmir. B - Case Study of the Island of Rhodes. MAP Technical Reports Series No. 72. UNEP, Athens, 1993 (64 pages) (English only).
73. UNEP/FAO: Final Reports on Research Projects Dealing with the Effects of Pollutants on Marine Communities and Organisms. MAP Technical Reports Series No. 73. UNEP, Athens, 1993 (186 pages) (English and French).
74. UNEP/FIS: Report of the Training Workshop on Aspects of Marine Documentation in the Mediterranean. MAP Technical Reports Series No. 74. UNEP, Athens, 1993 (38 pages) (English only).
75. UNEP/WHO: Development and Testing of Sampling and Analytical Techniques for Monitoring of Marine Pollutants (Activity A). MAP Technical Reports Series No. 75. UNEP, Athens, 1993 (90 pages) (English only).
76. UNEP/WHO: Biogeochemical Cycles of Specific Pollutants (Activity K): Survival of Pathogens. MAP Technical Reports Series No. 76. UNEP, Athens, 1993 (68 pages) (English and French).
77. UNEP/FAO/IAEA: Designing of monitoring programmes and management of data concerning chemical contaminants in marine organisms. MAP Technical Reports Series No. 77. UNEP, Athens, 1993 (236 pages) (English only).
78. UNEP/FAO: Final reports on research projects dealing with eutrophication problems. MAP Technical Reports Series No. 78. UNEP, Athens, 1994 (139 pages) (English only).
79. UNEP/FAO: Final reports on research projects dealing with toxicity of pollutants on marine organisms. MAP Technical Reports Series No. 79. UNEP, Athens, 1994 (135 pages) (parts in English or French only).
80. UNEP/FAO: Final reports on research projects dealing with the effects of pollutants on marine organisms and communities. MAP Technical Reports Series No. 80. UNEP, Athens, 1994 (123 pages) (English only).
81. UNEP/IAEA: Data quality review for MED POL: Nineteen years of progress. MAP Technical Reports Series No. 81. UNEP, Athens, 1994 (79 pages) (English only).
82. UNEP/IUCN: Technical report on the State of Cetaceans in the Mediterranean. MAP Technical Reports Series No. 82. UNEP, Regional Activity Centre for Specially Protected Areas, Tunis, 1994 (37 pages) (English only).
83. UNEP/IUCN: Specially protected Areas in Mediterranean. Sketch of an Analytical Study of Relevant Legislation. MAP Technical Reports Series No. 83. UNEP, Regional Activity Centre for Specially Protected Areas, Tunis, 1994 (55 pages) (French only).
84. UNEP: Integrated Management Study for the Area of Izmir. MAP Technical Reports Series No. 84, UNEP, Regional Activity Centre for Priority Actions Programme, Split, 1994 (130 pages) (English only).
85. UNEP/WMO: Assessment of Airborne Pollution of the Mediterranean Sea by Sulphur and Nitrogen Compounds and Heavy Metals in 1991. MAP Technical Report Series No. 85, Athens, 1994 (304 pages) (English only).

86. UNEP: Monitoring Programme of the Eastern Adriatic Coastal Area - Report for 1983-1991. MAP Technical Report Series No. 86, Athens, 1994 (311 pages) (English only).
87. UNEP/WHO: Identification of microbiological components and measurement development and testing of methodologies of specified contaminants (Area I) - Final reports on selected microbiological projects. MAP Technical Reports Series No. 87, UNEP, Athens, 1994 (136 pages) (English only).
88. UNEP: Proceedings of the Seminar on Mediterranean Prospective. MAP Technical Reports Series No. 88, UNEP, Blue Plan Regional Activity Centre, Sophia Antipolis, 1994 (176 pages) (parts in English or French only).
89. UNEP: Iskenderun Bay Project. Volume I. Environmental Management within the Context of Environment-Development. MAP Technical Reports Series No. 89, UNEP, Blue Plan Regional Activity Centre, Sophia Antipolis, 1994 (144 pages) (English only).
90. UNEP: Iskenderun Bay Project. Volume II. Systemic and Prospective Analysis. MAP Technical Report Series No. 90, Sophia Antipolis, 1994 (142 pages) (parts in English or French only).
91. UNEP: A Contribution from Ecology to Prospective Studies. Assets and Issues. MAP Technical Reports Series No. 91, Sophia Antipolis, 1994 (162 pages) (French only).
92. UNEP/WHO: Assessment of the State of Pollution in the Mediterranean Sea by Carcinogenic, Mutagenic and Teratogenic Substances. MAP Technical Reports Series No. 92, UNEP, Athens, 1995 (238 pages) (English only).
93. UNEP/WHO: Epidemiological studies related to the environmental quality criteria for bathing waters, shellfish-growing waters and edible marine organisms. MAP Technical Reports Series No. 93, UNEP, Athens, 1995 (118 pages) (English only).
94. UNEP: Proceedings of the Workshop on Application of Integrated Approach to Development, Management and Use of Water Resources. MAP Technical Reports Series No. 94, UNEP, Athens, 1995 (214 pages) (parts in English or French only).
95. UNEP: Common measures for the control of pollution adopted by the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution. MAP Technical Reports Series No 95, UNEP, Athens, 1995 (69 pages) (English and French).
96. UNEP/FAO: Final reports of research projects on effects (Research Area III) - Pollution effects on plankton composition and spatial distribution, near the sewage outfall of Athens (Saronikos Gulf, Greece). MAP Technical Reports Series No. 96, UNEP, Athens, 1996 (121 pages) (English only).
97. UNEP/FAO: Final reports of research projects on effects (Research Area III) - Pollution effects on marine communities. MAP Technical Reports Series No. 97, UNEP, Athens, 1996 (141 pages) (English and French).
98. UNEP: Implications of Climate Change for the Albanian Coast. MAP Technical Reports Series No. 98, UNEP, Athens, 1996 (179 pages) (English only).
99. UNEP: Implications of Climate Change for the Sfax Coastal Area (Tunisia). MAP Technical Reports Series No. 99, UNEP, Athens, 1996 (326 pages) (English and French).
100. UNEP: State of the Marine and Coastal Environment in the Mediterranean Region. MAP Technical Reports Series No. 100, UNEP, Athens, 1996 (142 pages) (English only).
101. UNEP: State of the Marine and Coastal Environment in the Mediterranean Region. MAP Technical Reports Series No. 101, UNEP, Athens, 1996 (148) (French only).

102. UNEP: Implications of Climate Change for the Coastal Area of Fuka-Matrouh (Egypt). MAP Technical Reports Series No. 102, UNEP, Athens, 1996 (238 pages) (English only).
103. UNEP/FAO: Final reports on research projects dealing with biological effects (Research Area III). MAP Technical Reports Series No. 103, UNEP, Athens, 1996 (128 pages) (English and French).
104. UNEP/FAO: Final reports on research projects dealing with eutrophication and heavy metal accumulation. MAP Technical Reports Series No. 104, UNEP, Athens, 1996 (156 pages) (English and French).
105. UNEP/FAO/WHO: Assessment of the state of pollution of the Mediterranean sea by zinc, copper and their compounds. MAP Technical Reports Series No. 105, UNEP, Athens, 1996 (288 pages) (English and French).
106. UNEP/FAO/WHO: Assessment of the state of eutrophication in the Mediterranean sea. MAP Technical Reports Series No. 106, UNEP, Athens, 1996 (456 pages) (English and French).
107. UNEP/WHO: Guidelines for authorisation for discharge of liquid wastes into the Mediterranean Sea. MAP Technical Reports Series No. 107, UNEP, Athens, 1996 (200 pages) (English and French).
108. UNEP/WHO: Assessment of the state of microbiological pollution of the Mediterranean Sea. MAP Technical Reports Series No. 108, UNEP, Athens, 1996 (270 pages) (English and French).