Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Working Group on Oceanographic Co-operation in the ROPME Sea Area

First Meeting

Paris, 12-14 June 1991

UNESCO

In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of «El Niño» *(Also printed in Spanish)*
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping *(Also printed in French and Spanish)*
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica *(Spanish only)*
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources *(Also printed in French and Spanish)*
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities *(Also printed in Spanish)*
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of « El Niño » *(Also printed in Spanish)*
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN (OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean
53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic *(Also printed in French)*
54. Third session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico *(Also printed in Spanish)*
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping
59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Intercalibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Working Group on Oceanographic Co-operation in the ROPME Sea Area

First Meeting

Paris, 12-14 June 1991

THIS REPORT IS A REVISED VERSION OF DOCUMENT IOC/WGOCR-I/3, WHICH IS TO BE CANCELLED

UNESCO

IOC/WGOCR-I/3 rev.
Paris 19 September 1991
English only

TABLE OF CONTENTS

SUMMARY REPORT

ANNEXES

1. OPENING

1 The meeting was declared open by 10 a.m. on Wednesday 12 June 1991 by the Deputy Secretary IOC, Dr. Klaus Voigt, on behalf of the Secretary IOC who was unavoidably absent.

2 In his speech, Dr. Voigt traced the background of this meeting to the agreement between relevant United Nations Agencies initiated through the co-ordinating efforts of UNEP (Geneva, 6-7 February and 15 March 1991), to co-operate in finding solutions to war-related environmental problems in the ROPME Region, as well as to Resolution XVI-14 of the IOC Assembly (7-21 March 1991). He stated that the primary objectives of the meeting were to agree on operational co-ordination between persons/agencies/countries interested in the planning and execution of the "WET" components of the United Nations Inter-Agency Plan of Action and to consider the elaboration of a longer term programme for the study and monitoring of the ecological impacts in, and recovery of, the coastal and marine environment in the ROPME Region. This would minimize duplication of efforts, optimise output within the limited budgets available and ensure that those concerned do not fall over each other in trying to achieve similar goals.

3 Dr. Voigt expressed great satisfaction over the presence at the meeting of experts from the region, the international community and the United Nations System. He heartily welcomed the participants and wished them fruitful deliberations.

4 In a message read by Dr. Voigt, the Director-General of Unesco, Dr. Federico Mayor, expressed regret that his schedule did not permit him to join the meeting. He had asked the Secretary of IOC to transmit his greetings and best wishes for a successful meeting to all participants. The Director-General said that he is following closely the work of the Intergovernmental Oceanographic Commission in this subject area and is looking forward to receiving advice and conclusions from this meeting.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

5 The Provisional Agenda (Document IOC/WGOCR-I/1 prov.) was adopted as the Agenda for the meeting and is attached as Annex I of the report.

2.2 ELECTION OF CHAIRMAN, VICE-CHAIRMAN AND DESIGNATION OF RAPPORTEUR

6 Dr. Nizar Ibrahim Tawfiq, Vice-President of Meteorology and Environmental Protection Administration (MEPA), Saudi Arabia, and Dr. G.S. Quraishee, Fourth Vice Chairman of IOC, were elected by acclamation Chairman and Vice-Chairman respectively.

7 Dr. Mahmood Y. Abdulrahim, Deputy Director of the Kuwait Environmental Protection Council, was designated as the Rapporteur.

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

8 The Technical Secretary, Dr. Chidi Ibe, introduced the provisional Timetable and the List of Documents (Annex IX). He explained that the basic

working document will be the "Guidelines for the Meeting" (Document IOC/WGOCR-I/6).

9 The meeting was attended by sixty participants from the ROPME Region, other Member States of IOC and from United Nations and other international/national organisations. Their names and affiliations are given in Annex III.

3. INTRODUCTION OF GUIDING DOCUMENTS

10 In introducing the Guiding Document entitled "Guidelines for the Meeting", the Technical Secretary said that its objective is to structure discussions along productive lines.

11 He explained that an appropriately designed project for natural resources damage assessment should have three major but oftentimes overlapping phases as follows:

(i) Reconnaissance (pre-assessment) survey

The objective of this phase is to gather as much background information as possible on the oil spill (and burning oil wells) so as to be able to determine what actions will be necessary towards a credible assessment of ecological impacts and the planning for restoration of the habitats to their natural or pre-spill conditions, where feasible.

(ii) Short and Long-term Assessment of ecological Impacts

This phase is concerned with a multidisciplinary plan (covering physics, chemistry, biology and geology) for a comprehensive assessment of the damage to natural resources and amenities caused by the oil spill and effects of burning oil wells. This should lead to a clear identification of all affected areas and has two time frames-short-and long term.

(iii) Restoration planning

This involves a review of available methods and technologies for the restoration of habitats, living resources and amenities impacted by oil and oil related pollutants (from burning oil wells) to their natural or pre-incident conditions and selecting those that are appropriate for particular circumstances.

Restoration planning oftentimes is a necessary step from the onset of the incident.

4. FORMULATION OF A PROJECT PLAN

12 The UNEP Representative, Dr. Makram Gerges, gave a brief history of the United Nations Inter-agency Plan of Action and presented a status report on its implementation. His report is attached as Annex IV. His report set the stage for in-depth discussions on the format and contents of a project plan.

4.1 PRE-ASSESSMENT SURVEY

13 The Chairman called upon all those countries/agencies/individuals who have been involved in one capacity or another in tackling the problems caused by the oil spill and burning oil wells to give the meeting the benefit of their experiences.

14 On behalf of MEPA, Dr. Nizar Tawfiq recounted the involvement of his organisation in oil spill response as well as on-going studies to determine their effects on the natural resources in the area. He pointed out that the spill had multiple sources (i.e. from terminals, tankers, storage tanks). He highlighted the work of the round the clock oil spill response centres in Dahrain and Jeddah operated by MEPA with international assistance. An existing oil spill model was operated and the response was satisfactory. As a result, desalination and power plants were effectively protected.

15 Oil recovery operations were fairly successful. The shallowness in certain near shore areas and the existence of industrial facilities in others hampered greater recovery. He said that 1.4 million barrels of oil have been recovered to date representing 18-23% of an estimated 6-8 millions barrel spilled. Presently there is very little oil either being recovered or still on the sea. The major areas of impact are along 560 km of the Saudi coastline where about 900.000 barrels of oil are stranded on beaches, salt marshes, mangrove areas, etc.

16 He gave indication of figures of wildlife affected; between 20-30.000 birds have died so far because of the spill. There is no great casualty among the turtles but fish, shrimps and mussels seem to be affected although the exact extent is still being studied. The Wildlife Rehabilitation Centre in Saudi Arabia has been active in the cleaning up and rehabilitation of affected wildlife.

17 He went on to say that his agency was proud of its achievements in fighting the oil spill and that it was trying to prioritise areas that still need cleaning up. He called for assistance particularly in the cleaning-up of beaches. He said the main focus of activities should now shift to damage assessment and possible rehabilitation of affected areas and said this meeting was timely to achieve regional coverage and co-ordination in these phases.

18 Dr. Tawfiq's presentation was complemented by that of Dr. Dabbagh, Director of the Research Institute, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia, who showed sequential satellite imageries tracking the spilled oil and gave an account of a preliminary assessment of the environmental and health impacts of oil burning in the Kuwaiti Oil fields. The study was commissioned by MEPA and is on-going. The report is attached as Annex V.

19 Dr. Olof Linden, IOC Consultant, gave an account of the IOC Reconnaissance Survey of the Coastal and Marine Environment of Bahrain, Kuwait, and Saudi Arabia undertaken by himself and Dr. Arne Jernelov. An abridged version of his report which includes recommendations for future work is attached as Annex VI.

20 Dr. Robert Clarke Jr. gave a brief presentation of a fact finding/technical consultation mission to Bahrain and Saudi Arabia carried out

by six scientists from the U.S. Fish and Wildlife Service, U.S. Food and Drug Administration and NOAA. The objectives he said were to investigate marine resources at risk and to determine actual and potential impacts.

21 Dr. Sylvia Earle, Chief Scientist at NOAA, who led the US Mission to Bahrain and Saudi Arabia, made a video tape and slides assisted presentation.

22 Dr. Earle's presentation focused on the experiences gathered from her trips to the region, as co-ordinator of NOAA's supporting activities in the region, particularly in the inventory of natural resources data bases in the region; the desirability and usefulness of scientific co-ordination (at the administrative and scientific levels); mutual international technology transfer and co-operation including training and sharing of experiences and expertise.

23 Dr. Jean Jaubert, Director of the "Observatoire océanologique européen de Monaco", presented his findings from an underwater diving expedition in the Gulf in March. This showed clearly that the corals and some of the sea grass beds were already being affected at that time. He specifically mentioned the recorded and anticipated drops in temperature as a result of the soot and other products of the burning oil wells and said this could be detrimental to the well being of fauna and flora in the area.

24 Dr. Mahmood Abdulrahim, Deputy Director of the Kuwait Environmental Protection Council, gave an account of the research being carried out presently in Kuwait the areas of marine and atmospheric chemistry and said some baseline data exist against which currently acquired or future data can be compared.

25 He gave examples of results from air pollution monitoring in Kuwait including gases (SO2, NOX, CO, etc. and hydrocarbons), suspended particulate matter (PM-10 and high volume samplers), and settled dust on residential areas. The results indicate that levels of suspended particulates could reach up to 400 ug/m3, with extractable organic matter trends ranging up to 1300 ug/mg of particulate matter collected.

26 A research plan proposed by the Council involves assessment of the environmental impact of the oil spills and that of the fall-out of petroleum particles and burning residues from the burning oil wells. The plan also calls for two level approaches, a national component emphasizing the specific needs and problems of Member States, and a regional component directed at the more common issues impacting the whole region.

27 The oil spill component involves the identification of sources, quantities and rate of input into the environment, review of available data on the region, selection of representative habitats/populations to be studied and carrying out a national and a regional programme simultaneously looking at total and specific PAHs and heavy metals in the sediment and biota. The component of oil well fires includes monitoring of the composition of particulate matter and amount of fall-out on the marine environment. Core analysis comprising present composition of sediment to install data is also recommended.

28 In summarizing this Agenda Item, the Chairman said that the presentations as well as questions/contributions by other participants have given indications of the extent of work needed to carry out a credible assessment of the effects of the oil spill and the burning oil wells.

4.2 SHORT-TERM AND LONG-TERM IMPACT ASSESSMENT

29 Under this Agenda Item, experts gave their views on what they consider to be the main elements of such an assessment. The Chairman advised that only such broad outlines were required because specific details would be discussed at the sub-group level. Participants defined two time scales: short-term assessment covering between 12 months or more and the more long-term assessment covering about 3 to 5 years time span.

30 One item which was missing in the IOC preliminary proposal was the subject of air-sea interaction. The Chairman called for contributions in this area and invited Dr. Jose Heintzenberg of the University of Stockholm to make a presentation. In his brief lecture entitled "Knowns and unknowns aboat soot emissions from the burning oil wells", Dr. Heintzenberg explained that the amount and types of fuel burning in Kuwait are unknown. Roughly the amount of elemental carbon emitted by that combustion is known as are the size and optical properties of the soot particles. Important in an assessment of the impact of the combustion products on the marine environment are reactive and toxic compounds associated with the elemental carbon. Very little, though, is known about that fraction. The atmospheric lifetime of the soot particles (i.e. elemental carbon plus reactive and toxic associates) determines the extent of the area that will be affected by the plume. Particle size, density and hygroscopic properties determine the atmospheric lifetime. Little is known about the latter two parameters. Once deposited on the sea surface, soot particles will interact physically, chemically and biologically with the surface film and the mixed layer before settling (possibly in modified form) on the bottom. Even less is known about these processes though they might be essential in studying the impact of the smoke plume on the marine ecosystem. Following this presentation, the meeting agred that details of the investigation required to give clarity to the problem of air-sea interaction should be referred to the meeting of the sub-group on chemistry.

31 On behalf of IUCN, Dr. Andrew Price gave a brief outline of his organisation's plans for the study of the impacts of war-related pollution within the context of the United Nations Inter-agency Plan of Action. He stressed that because of the commonality of objectives, co-ordination of efforts was vital. This was the underlying consideration for IUCN's participation in the meeting. He pointed out that IUCN has historical data on certain coasts in the ROPME Region and would be glad to make such data available to interested parties.

32 Contributing to the discussion, Dr. I. Readman, Acting Head of the International Laboratory of Marine Radioactivity of the International Atomic Energy Agency in Monaco, informed the meeting that his Laboratory had sent out staff to the region for sample collection and would be willing, under some arrangements, to share the samples collected. He said his Laboratory would be willing to assist in the analysis of samples for those participating in the United-Nations Inter-agency Plan of Action. He indicated, however, that for certain analysis like PAH's (Polycyclic Aromatic Hydrocarbons), there will be

need to expand the capacity of his Laboratory by joint funding of the post of an analyst specialised in this field.

4.3 RESTORATION PLANNING

33 Discussions under this Agenda item centered on the appropriate methodologies and technologies for restoring impacted areas, living resources and amenities to their natural or pre-spill conditions, where feasible.

34 Participants pointed out that certain elements of the oil spill response, e.g. cleaning and rehabilitation of affected wildlife, form part of this undertaking.

35 It was stressed that there must be appropriate scientific criteria for whatever actions are proposed in this regard.

4.4 ROLES FOR THE GIPME GROUPS OF EXPERTS ON EFFECTS OF POLLUTANTS (GEEP), ON METHODS, STANDARDS AND INTERCALIBRATION (GEMSI), AND ON STANDARDS AND REFERENCE MATERIAL (GESREM)

36 The Chairman pointed out that the meeting was lucky to have among the participants Dr. Brian Bayne who is Chairman of GEEP and Dr. Kathryn Burns who has had a long association with GEMSI and the wider GIPME Programme and called upon them to make their presentations.

37 Dr. Bayne referred the meeting to the report of the last meeting of the IOC's Committee for the Global Investigation of Pollution in the Marine Environment (GIPME) and stated that this report contained the major objectives of this group of experts as well as its work programme for the future. He expressed satisfaction that as a result of the work of GEEP which has been in existence only for a short while, certain biological indicators of great subtlety and high sensitivity now exist, and hoped that some of these methods will be incorporated in the plan for project implementation.

38 Dr. Burns equally referred participants to the report of the last meeting of the Committee for GIPME which presents highlights of the objectives and future workplan of both GEMSI and GESREM. She referred to the publication under the "Reference Methods for Marine Pollution Studies" Series issued as a result of the activities of GEMSI and GESREM and said that if they were adopted in the ROPME Region they would make for intercomparability of results to be achieved from studies embodied in the U.N. Inter Agency Plan of Action.

39 Some participants referred also to the existence of a ROPME Manual which incorporates standardised methodologies and noted that this could also be useful as the basis for a region wide undertaking.

4.5 DATA MANAGEMENT AND EXCHANGE

40 Dr Geerders introduced this Agenda Item and clarified his position by stating that since mid-April 1991 he has been under contract with UNEP as Technical Adviser of the UNEP Core Group in Kuwait created in the framework of the United Nations Inter-agency Plan of Action for the ROPME Region. His

main tasks relate to the development and implementation of a data system for the Core Group. In this capacity he visited Kuwait twice.

41 Complete and accurate information and numerical data form an essential basis for assessment and measures. In the development of the data system for the Core Group, the achievements of the IOC Committee on International Oceanographic Data and Information Exchange (IODE), and of the International Council for the Exploration of the Seas (ICES), have been used as references. The meeting was advised to refer to the internationally accepted standard formats and guidelines developed by these two agencies.

42 The data system consists essentially of three parts: first level inventory information (who, where, what, when, ...), a second level of numerical data and a third level of products for assessment purposes.

43 Not much information and data have been passed to the Core Group as yet although many activities have apparently taken place. Dr. Geerders indicated that he had experienced a certain reluctance with scientists and their organizations to submit their data to the Core Group. In some cases there even appeared to be a censorship on data from the Gulf region. He stated that the UN Interagency effort in the Gulf region can only be effective and successful if the required data and information are made available in a timely fashion to the Core Group. He mentioned however that baseline data, acquired by ROPME during the last few years, had been recovered and will be incorporated in the data system.

44 Since the data system will incorporate data from different sources, much attention should be given to quality assurance and quality control. Also the lack of common methods and techniques forms an additional problem. Intercalibration exercises are required not only for the marine environment but also for terrestrial and atmospheric measurements.

45 Many areas inland, as well as on the beaches and the marine environment in Kuwait, are not accessible for direct measurements because of mines and other dangerous materials. Therefore, besides *in situ* data, Remote Sensing data from aircraft and satellites will play an important role.

46 In his contribution, Dr. M.B. de Vries, of Delft Hydraulics, Netherlands, focused on the design and implementation of a Data-System for the UN-Interagency Plan of Action for the ROPME Region. He stated that a computerized data-system is developed to permit :

(i) adequacy of the data to support the development of effective implementation plans;

(ii) to enable the assessment of the impacts in four areas of activity and

(iii) to assess the requirements for the design of the implementation plans.

47 The data-system is developed by Delft Hydraulics in concert with other Dutch research institutes. Due to time and financial constraints, the data-system will be limited to results from the assessment of oil related pollution. The design and implementation of the system is largely based on

existing and readily available software. It will consist of data-entry, data-retrieval, and both statistical and geographical data-assessment facilities. In agreement with the UN-Interagency plan, the four areas of activity consist of:

(i) a entry-module for sources of pollution;

(ii) a facility for entry of environmental characteristics;

(iii) a standards and criteria database (including dose-effect data) and

(iv) a facility for description of distribution and fate of the pollutants.

48 Set-up and implementation of the data-system are co-ordinated and discussed between the United Nations agencies. The system, including hardware and interfacing facilities, will be implemented at the ROPME offices at Kuwait City before the end of July. Data-entry of all sorts of information will be realized by ROPME. Delft Hydraulics will train and assist ROPME staff to realize a valid database.

49 In the ensuing discussions, some experts from the region pointed to the existence already in some countries in the region of credible data bases. Some others informed the meeting of prior attempts by ROPME towards a centralised data base and wondered in view of the progress made, if the new attempts under the United Nations Inter-agency Plan of Action are not an unnecessary duplication.

50 Following further discussions, the meeting welcomed this attempt at a common data base for the region but went on to call for the establishment also of data centres in those countries where they do not presently exist and stressed that for the data collected to be meaningful, they must be freely available to all interested end-users.

4.6 FORMATION OF SUB-GROUPS

51 The Technical Secretary explained that following the first day of plenary, it was considered optimimal that the meeting break into sub-groups with experts participating along the lines of their specialisation, i.e.:

(i) marine chemistry,

(ii) marine biology,

(iii) physical and geological oceanography, and

(iv) policy and international co-operation.

52 He explained that it is at the sub-group level that particular details of work to be undertaken will be articulated, complete with a time table, cost estimates and identification of needs for the implementation. He added that each sub-group would have a chairman who will be assisted by a member of the meeting secretariat.

53 The Technical Secretary then announced the names of experts largely according to their preferences. A list had earlier been passed and participants had been asked to elect to belong to one of the four sub-groups. The List of Participants according to sub-groups is attached as Annex VII.

54 The duration of the meeting of sub-groups was half a day and the Chairman of the sub-groups would be responsible for presenting the reports of their sub-groups when the meeting re-convened in Plenary in the afternoon of the second day.

5. MEETING OF SUB-GROUPS

55 The four sub-groups formed above met separately and produced reports which would form the basis of the sub-group's input into the Integrated Project Plan.

6. REPORTS OF SUB-GROUPS

56 When the meeting re-convened in plenary, the Chairman of each sub-group presented the report of his sub-group along the lines of the terms of reference specified for the conduct of the meeting of the sub-groups.

57 Each report was discussed and suggestions made for their improvement.

58 The sub-groups were then asked to finalise their reports and submit to the Secretariat. The reports of the sub-groups are attached as appendixes to the Integrated Project Plan (see Annex VIII).

7. DRAFTING GROUPS

59 The Chairman, Dr. Nizar Tawfiq, suggested that only one Drafting Group should be formed and should comprise the Bureau of the Meeting and the Chairmen of the sub-groups in addition to one or two invited participants.

60 The drafting group met and set the guidelines for the preparation of an Integrated Project Plan by the Rapporteur with the assistance of the Secretariat.

61 The Chairman requested that existing project plans should be taken into account.

8. INTEGRATED ACTION PLAN FOR THE COASTAL AND MARINE ENVIRONMENT

62 A document entitled Integrated Project Plan for the coastal and Marine Environment of the ROPME Region which is a synthesis of the reports of the sub-groups was presented to the meeting for consideration.

63 The Plan is attached as Annex VIII.

64 Welcoming the general objectives and approaches outlined in the Integrated Project Plan including the mechanism for achieving regional and international co-ordination, the meeting felt there was a need to form a Steering Committee to:

(i) co-ordinate the activities to be carried out as a result of this plan, and

(ii) elaborate/update this project plan as deemed necessary to achieve its overall objectives,

and that this should be included as a specific recommendation of the meeting. The Secretariat indicated that it had no difficulty in accepting this recommendation and would convey it for possible implementation to the Secretary IOC. The recommendation is attached as Annex VIII.

65 The meeting also appealed to countries in the region to facilitate the movement of identified external experts and equipment in and out of their countries in order to ensure a speedy implementation of the Project Plan.

9. RESOLUTION XVI-14 AND REGIONAL RESOURCES NEEDS (HUMAN, MATERIAL, FINANCIAL)

66 The Technical Secretary introduced the main elements contained in this Resolution and explained that its principal objective was to achieve oceanographic co-operation in the ROPME Sea Area.

67 The participants welcomed the main provisions of the Resolution and requested the Secretary to vigorously pursue their implementation.

68 Experts from Kuwait welcomed in particular the other provisions embodied in the Resolution requesting the Secretary IOC to make good the losses suffered by their country as a result of the war by providing oceanographic facilities, equipment and books to Kuwait.

10. PREPARATION OF DRAFT SUMMARY REPORT

69 After the morning session on the third day, the participants discussed several related issues to enable the Rapporteur and the Secretariat to finalize a Draft Summary Report.

11. ADOPTION OF THE REPORT

70 The meeting deliberated on the Draft Summary Report and made minor corrections to the text, and thereafter mandated the Secretariat to finalize the report for distribution.

71 The Draft Summary Report was then adopted, with one recommendation (see Annex II).

12. CLOSURE

72 At the beginning of the closing formalities, the Scientific Adviser in the Permanent Delegation of the Islamic Republic of Iran to Unesco, Dr. Ghassem Djaberipur, asked for an opportunity to make the following statement:

"Mr. Chairman, distinguished Scientist, ladies and gentlemen,

I am very sorry that because of the very short notice, the Iranian experts who were supposed to come to this meeting could not get their entrance visa to France on time. I did not want to actually have any intervention in the course of your important work, because I have no specialty in oceanography or related disciplines. But some of the colleagues from our neighbouring countries in Persian Gulf kindly expressed their pity that our experts could not make it to join you and they encouraged me to say something on their behalf. I have the honour to have attended in part of your deliberations, and I could have presented to you some information about the affected shores and waters along the northern coast of the Persian Gulf and the islands in our waters by oil spills and black rain. These information are limited to what I have recollected from some Iranian newspapers. But I would have preferred to give a report on the basis of scientific gatherings of my colleagues back home which unfortunately I have received none.

To conclude, Mr. Chairman, I can assure you that, the authorities of the Islamic Republic of Iran would definitely welcome any scientific mission from IOC for data gathering and observation. They would be very cooperative and my colleagues in recently stablished institute for oceanography have expressed their readiness to host any short term or long term mission to work on the whole affected area of the Persian Gulf and Sea of Oman, specially at this time that all our moslem brother countries in the south of Persian Gulf and Sea of Oman have realized our good will and brotherhood, now that we enjoy very good relations, we hope that we work together closely and friendly to overcome all the problems. We try to be as cooperative as one could possibly be.

Thank you, Mr. Chairman".

73 In his closing remarks, the Chairman thanked all the participants for the hard work put in over the three days of the meeting.

74 He expressed the hope that the Integrated Project Plan would serve as a basis for a co-ordinated and meaningful study of the environmental consequences of the Gulf War particularly with respect to the problems caused by the massive oil spill and burning oil wells.

75 He went on to say that the prime preoccupation for those who live in the Gulf Region is the safety of food, drinking water and air and noted that for scientists and environmentalists in the region, the duties and responsibilities are immense. He called on the international community to provide the much needed assistance and support in the relevant scientific fields, stressing that co-operation is a necessity, if the region has to meet the expectations of safety and quick recovery for the marine and coastal area. IOC can provide credibility to their international efforts by providing the necessary mechanism for co-ordination, follow-up, and bringing the plan to fruition. The Chairman stressed the importance of the recommendation of the meeting to the Secretary IOC to create a Steering Committee as a viable mechanism for project implementation.

76 Dr. John Knauss, Administrator of NOAA and First Vice-Chairman of IOC, said that the Chairman's views accord with the legitimate expectations

of the marine scientific community, and that providing a co-ordination mechanism in the form of a Steering Committee is an appropriate role for IOC to play. Many other experts spoke in the same vein.

77 The Chairman then expressed confidence that with the implementation by the Secretariat of the recommendation to put a Steering Committee in place as soon as possible, the project would well be on its way to fulfiling the expectations behind its formulation.

78 In closing the meeting, the Deputy Secretary IOC, Dr Klaus Voigt, on behalf of the Secretary IOC, again thanked the participants for accepting IOC's invitation to the meeting and for contributing positively towards its success. He said that a Steering Committee would be set up soon in fulfilment of the recommendation of the meeting and that IOC would consult with ROPME to determine how best this Committee would function. He said IOC was full of hope that out of the negative event of the Gulf War would emerge possible lessons on the need for regional and international co-operation for the benefit of the environment and human kind. He wished the participants a safe journey to their respective stations.

79 The meeting was closed at 4.30 p.m. on Friday 14 June 1991.

ANNEX I

AGENDA

1. OPENING

2. ADMINISTRATIVE ARRANGEMENTS

   2.1 ADOPTION OF THE AGENDA
   2.2 ELECTION OF CHAIRMAN AND DESIGNATION OF RAPPORTEUR
   2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

3. INTRODUCTION OF GUIDING DOCUMENT

4. FORMULATION OF A PROJECT DOCUMENT

   4.1 PRE-ASSESSMENT SURVEY
   4.2 SHORT-TERM AND LONG-TERM IMPACT ASSESSMENT
   4.3 RESTORATION PLANNING
   4.4 ROLES FOR THE GIPME GROUPS OF EXPERTS ON EFFECTS OF POLLUTANTS (GEEP), ON METHODS, STANDARDS AND INTERCALIBRATION (GEMSI), AND ON STANDARDS AND REFERENCE MATERIAL (GESREM)
   4.5 DATA MANAGEMENT AND EXCHANGE
   4.6 FORMATION OF WORKING GROUPS

5. MEETING OF SUB-GROUPS

6. REPORTS OF SUB-GROUPS

7. DRAFTING GROUPS

8. INTEGRATED ACTION PLAN FOR THE COASTAL AND MARINE ENVIRONMENT

9. RESOLUTION XVI-14 AND REGIONAL RESOURCES NEEDS (HUMAN, MATERIAL, FINANCIAL)

10. PREPARATION OF DRAFT SUMMARY REPORT

11. ADOPTION OF THE REPORT

12. CLOSURE

ANNEX II

RECOMMENDATION FOR THE FORMATION OF A STEERING COMMITTEE FOR THE INTEGRATED PROJECT PLAN

The IOC Working Group on Oceanographic Co-operation in the ROPME Sea Area,

Considering the IOC participation in the coastal and marine environment components of the United Nations Inter-Agency Plan of Action in ROPME Region and the provision of IOC Resolution XVI-14 on Oceanographic Co-operation within the ROPME Sea Area,

Noting the keen interest of the national authorities in ROPME Sea Area and the international scientific community to contribute to the efforts required for the monitoring, assessment and rehabilitation of the coastal and marine environment,

Having approved an Integrated Project Plan for the Coastal and Marine Environment as a framework for further action,

Realizing the need for updating the scientific and budgetary components of the Integrated Project Plan and in mobilizing resources, and reinforcing scientific co-operation,

Recommends to IOC to establish a Steering Committee on Oceanographic Co-operation in the ROPME Sea Area, as an IOC special mechanism to be entrusted with the following duties:

(i) co-ordinate activities carried out as a result of or in concert with the Integrated Project Plan;

(ii) Elaborate and update the scientific and budgetary components of the Integrated Project Plan as deemed necessary to achieve its overall objectives; and

(iii) act as a clearing house for the main contributors and a forum for consultation and exchange of information;

Requests the IOC Secretary and Member States to give immediate attention to this matter, so that the Steering Committee can start its functions as soon as possible.

ANNEX III

LIST OF PARTICIPANTS

1. PARTICIPANTS FROM THE ROPME REGION

Dr. Mahmood Abdulrahim (Rapporteur)
Deputy Director
Environment Protection Council (EPC)
P.O. Box 24395
Safat
KUWAIT

tel: (965) 245 6833
tlx: 46408 EPLNCL
fax: (965) 2456 836

Dr. Ossama Aboul Dahab
Marine Pollution Specialist
Department of Marine Sciences
Faculty of Sciences
Qatar University
Doha
QATAR

tel: (974) 892 130 or 874 961
fax: (974) 835 111

Dr. Abdul Nabi Al-Ghadhban
Researcher
Kuwait Institute for Scientific Research
P.O. Box 24885
Safat
KUWAIT

tel: (965) 5510 424 (home)

Dr. Manaf Behbehani
Assistant Professor
Department of Zoology
Faculty of Science
University of Kuwait
Safat
KUWAIT

tel: (965) 483 0420
tel: (965) 551 9424
cable: KUNIVER, KUWAIT

Dr. Abdallah Dabbagh
Director
The Research Institute
King Fahd University of Petroleum and Minerals (KFUPM)
Dhahran 31261
SAUDI ARABIA

tel: (966 3) 860 3319
tlx: 801 913 KFUPMI
fax: (966 3) 860 3661

Mr. Ghassem Djaberipur
Scientific Adviser
Delegation of the Islamic Republic of Iran
1, rue Miollis
75015 Paris
FRANCE

tel: (33 1) 45 68 3295

Dr. Elsayed Mohamed Hassan
Professor
Department of Marine Sciences
Faculty of Science
Qatar University
P.O. Box 120003
Doha
QATAR

tel: (974) 892 134 (office)
(974) 831 094
tlx: 4630 UNVSTY DH
fax: (974) 835111

Dr. David Olsen
Planner
Meteorology and Environmental Protection Administration (MEPA)
P.O. Box 6969
Jeddah 21452
SAUDI ARABIA

tel: (966 2) 651 2312 ext.2975

Dr. Nizar Ibrahim Tawfiq (Chairman)
Vice-President of Meteorology and
Environmental Protection
Administration (MEPA)
P.O. Box 1358
Jeddah 21431
SAUDI ARABIA

tel: (966 2) 6519868

2. PARTICIPANTS FROM OTHER MEMBER STATES

Dr. Hassan Awad
Prof. of Marine Pollution
Dept. Oceanography
Faculty of Science
University of Alexandria
21511 Moharram Bey
Alexandria
EGYPT

tel: (20 3) 422 3126
tlx: 54467 UNIVY UN
fax: (20 3) 482 5630

Dr. Brian Bayne
Plymouth Marine Laboratory
Prospect Place
Plymouth PL1 3DH
UNITED KINGDOM

tel: (44 752) 222 772
tlm: B.BAYNE

Dr. Kathryn Burns
National Science Foundation (NSF)
17 Biological Stn. Lane
BERMUDA GE01

tel: (1 809) 297 1880
tlx: (1809) 297 8143
tlm: K.BURNS

Cdr. Francesca Cava
Special Assitant to the Under
Secretary
National Oceanic and Atmospheric
Administration (NOAA)
Doc NOAA 14th & Constitution NW,
Room 5128
Washington, D.C. 20230
U.S.A.

tel: (1 202) 377 3436
cable: OMNET - F.CAVA
fax: (1 202) 408 9674

Dr. Peter Chapman
Biochemist/Microbiologist
Environmental Protection Agency
Laboratory (EPA)
Sabine Island, Gulf Breeze
FL 32562
U.S.A.
tel: (1 904) 934 9200

Dr. Robert C. Clark, Jr.
Research Oceanographer
NOAA, US Dept. of Commerce
2725 Montlake Blvd. East
Seattle WA 98112-2097
U.S.A.

tel: (1 206) 553 5569
fax: (1 206) 553 2359

Ms. Izaak de Vries
Ecologist
Netherlands-Delft Hydraulics
P.O. Box 177
2600 MH Delft
NETHERLANDS

tel: (31 15) 569 353
fax: (31 15) 619 674

Ms. Mindert de Vries
Toxicologist
Rotterdamseweg 165
Delf Hydraulics
NETHERLANDS

tel: (31 15) 569 353

Dr. Sylvia Earle
Scientist
NOAA, US Department of Commerce
Washington, D.C. 20230
U.S.A.

tel: (1 202) 377 3436

Dr. Mahmoud El-Sayed
Professor of Marine Geology
Department of Oceanography
Faculty of Science
Alexandria University
Moharram Bey
Alexandria
EGYPT

tel: (20 3) 492 2918
tel: (20 3) 545 2723 (home)
tlx: 544 67 UNIVY UN
fax: (20 3) 597 1147

Dr. Mustafa Ergun
Associate Professor
D. Eyliul University
Institute of Marine Sciences and Technology
P.O. Box 478
35211 Izmir
TURKEY

tel: (90 51) 631659
tlx: 52407 DBTE TR
fax: (90 51) 225368

Mr. Atilio François
Centre de Documentation de Recherche et d'Experimentation sur les Pollutions Accidentelles des Eaux (CEDRE)
Pointe du Diable
B.P. 72
29280 Plouzane
FRANCE

tel: (33 16) 9849 1216
tlx: 940145 F
fax: (33 16) 9849 6446

Mr. Paul Geerders
IOC Consultant
Royal Netherlands Meteorological Institute (KNMI)
P.O. Box 201
3730 AE De Bilt
NETHERLANDS

tel: (31 30) 206 641
tlx: 47096 KNMI NL
fax: (31 30) 210 407

Mr. Michel Glémarec
Professor
Université de Bretagne Occidentale
Faculté des Sciences
Laboratoire d'Océanographie Biologique
6 avenue Victor Le Gorgeu
29283 Brest Cedex
FRANCE

tel: (33 16) 98 31 62 65

Dr. Anders Granlund
Senior Research Officer
Swedish Agency for Research with Developing Countries (SAREC)
P.O. Box 161 40
S-103 23 Stockholm
SWEDEN

tel: (46 8) 791 2172

Dr. John S. Gray
Professor
Department of Marine Zoology
University of Oslo
P.B. 1064
0316, Oslo 3
NORWAY

tel: (47 2) 454510
fax: (47 2) 454438
tlm: J.GRAY.OSLO

Dr. Alain Grotte
Remote Sensing Department
Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER/CEDRE)
Plouzane B.P. 70
29280 FRANCE

tel: (33 16) 98 22 43 18

Dr. Jost Heintzenberg
Associate Professor
Department of Meteorology
Stockholm University
SWEDEN

tel: (46 8) 162402
tlx: 15950 MISOS
fax: (46 8) 157185

Prof. Jean M. Jaubert
Director
Observatoire Océanologique Européen
16 Bd. de Suisse
98000 MC MONACO

tel: (33 16) 93 258 954
fax: (33 16) 93 302 474
(33 16) 93 521 729

Dr. Harold Kibby
Biologist (EPA)
200 S.W. 35th
Corvallis, OR 97333
U.S.A.

tel: (1 503) 757 4600
fax: (1 503) 757 4799

Dr. John A. Knauss
Under Secretary for Oceans and Atmosphere
NOAA, US Department of Commerce
Washington, D.C. 20230
U.S.A.

tel: (1 202) 377 3436

Mr. Stephen Lehmann
Scientific Support Co-ordinator
NOAA, 408 Atlantic Ave.
Boston, MA 0211
U.S.A.

tel: (1 617) 223 8016

Dr. Olof Linden
Institutet for Vatten-Och
Luftvardsforskning
Box 21060
10031 Stockholm
SWEDEN

tel: (46 8) 729 1500
tlx: 15581 IVL.S
fax: (46 8) 3185 16

Dr. Jacqueline Michel
Scientist
NOAA/Researcg Planning, Inc.
P.O. Box 328
Columbia SC 29202
U.S.A.

tel: (1 803) 256 7322
fax: (803) 254 6445

Mr. Pierre Michel
Environmental Chemistry Department
(IFREMER)
Rue de l'Ile d'Yeu
B.P. 1049
44037 Nantes
FRANCE

tel: (33 16) 4037 4134
tlx: 711 196
fax: (33 16) 4037 4073

Mr. Jacques Morelli
Centre National de la Recherche
Scientifique (CNRS)
Institut de Biogéochimie Marine
Ecole Normale Supérieure
1, rue Maurice Arnoux
92120 Montrouge
FRANCE

tel: (33 1) 4657 1286 ext/611
or 610
fax: (33 1) 4657 0497

Dr. Folarin Osotimehin
Professor
International Center for Development
Action (ICDA, Nigeria)
14, Allee Rene-Leriche
91300 Massy
FRANCE

tel: (33 16) 60 13 02 63

Dr. Jerry Payne
A/Head Experimental Sciences
Science Branch, Dept. Fisheries and
Oceans
St. John's NFLD
CANADA A1C 5X1

tel: (1 709) 772 2089
tlx: (772) 2156

Dr. Jan Piechura
Professor
Institute of Oceanology
Polish Academy of Sciences
ul. Powstancow Warszawy 55
Sopot
POLAND

tel: (48 58) 513021

Mrs. Birgit Quack
Marine Chemistry
Institut fuer Meereskunde an
der Universitaet Kiel
Duesternbrooker Weg 20
D-2300 Kiel 1
GERMANY

tel: (49 431) 597 3812
fax: (49 431) 565 876

Dr. G.S. Quraishee **(Vice-Chairman)**
Advisor to the National Institute
of Oceanography (NIO)
N.P.O. 37-K, Block 6, PECHS
Karachi
PAKISTAN

tel: (92 21) 434308
cable: OCEANOLOGY
tlx: 5678 PIC

Mr. Hugues Richer de Forges
Africa and Middle East Regional
Adviser (IFREMER)
155, rue J.J. Rousseau
92138 Issy-les-Moulineaux Cedex
FRANCE

tel: (33 1) 4648 2100
tlx: 631 912
fax: (33 1) 4648 2188

Mr. John Robinson
Director
Arabian Gulf Programme Officer
NOAA
14th Constitution Ave. NW, Rm 6224
Washington, D.C. 20230
U.S.A.

tel: (1 202) 377 0757
fax: (1 202) 377 0714
tlm: J.ROBINSON.HAZMAT

Ms. Marie Alexandrine Sicre
Laboratoire de Physique et Chimie Marines
CNRS
Tour 24-25, 5ème étage
4 Pl. Jussieu
75005 Paris
FRANCE

tel: (33 1) 4427 4864

Dr. Gordon Thayer
Research Team Leader
NOAA/National Marine Fisheries Service
Beaufort Laboratory, Beaufort
North Carolina 28516-9722
U.S.A.

tel: (1 919) 728 8747
tlx: (1 919) 728 8784

Dr. Anitra Thorhaug
Permanent Secretary and President
Greater Caribbean Energy and Environmental Foundation, Inc.
555 N.E. 15th Street, Penthouse H
Miami, FL 33132
U.S.A.

tel: (1 305) 371 9598

Dr. Magnus Torell
Senior Programme Officer
Swedish International Development Authority (SIDA)
105 25 Stockholm
SWEDEN

tel: (46) 8 728 5508
fax: (46) 8 673 2141

Dr. Peter Wiebe
Senior Scientist
Chairman of the Biology Department
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
U.S.A.

tel: (1 508) 548 1400

3. REPRESENTATIVES OF INTERNATIONAL ORGANIZATIONS

United Nations Environment Programme (UNEP)

Dr. Makram Gerges
Oceans and Coastal Areas Programme Activity Centre (OCA/PAC)
Senior Programme Officer
P.O. Box 30552
Nairobi
KENYA
tel: (2542) 333930/520600
cbl: UNITERRA NAIROBI
tlx: 25164 UNEPRS
fax: (2542) 520561

United Nation Educational, Scientific and Cultural Organization (UNESCO)

Dr. Amin H. Meshal
P.O. Box 3945
Doha
QATAR

tel: (974) 441 787
tlx: 4150 UNESCO DH
fax: (974) 447 784

International Union for the Conservation of Nature (IUCN)

Dr. Andrew R.G. Price
Marine Ecologist
Coastal and Marine Programme
Avenue du Mont Blanc
CH-1196, Gland
SWITZERLAND

tel: 4122 649239
fax: 4122 642926

International Atomic Energy Agency (IAEA)

Dr. James Readman
Head, Organic Chemistry Unit
International Laboratory of Marine Radioactivity
International Atomic Energy Agency
19, Av. des Castellans
MC-98000, MONACO

tel: (33 16) 93 504 488
tlx: 479378 ILMR
fax: (33 16) 93 257 346

4. OBSERVERS

Dr. Faisal Al-Salem
Permanent Delegation of Kuwait to UNESCO
1, rue Miollis
75015 Paris
FRANCE

tel: (33 1) 4734 5215

Dr. Demiris Themistoklis
Permanent Delegation of Greece to UNESCO
1, rue Miollis
75015 Paris
FRANCE

tel: (33 1) 4568 2981

5. IOC SECRETARIAT

Intergovernmental Oceanographic Commission

Unesco
7, Place de Fontenoy
75700 Paris
FRANCE

tel: (33 1) 4568 3980
tlx: 204461 F
fax: (33 1) 4056 9316
tlm: IOC.SECRETARIAT

Dr. Gunnar Kullenberg
Secretary

Dr. Klaus Voigt
Deputy Secretary

Dr. Chidi Ibe **(Technical Secretary)**
Senior Assistant Secretary

Dr. Gualter Soares
Senior Assistant Secretary

Consultants

Ms. Muriel Cole
Dr. Vassili Jivago
Dr. Selim Morcos

ANNEX IV

STATUS REPORT ON THE IMPLEMENTATION OF THE UN INTER-AGENCY PLAN OF ACTION FOR ADDRESSING THE ENVIRONMENTAL CONSEQUENCES OF WAR IN THE KUWAIT ACTION PLAN REGION

BACKGROUND

1. The Second Special Session of the Governing Council of the United Nations Environment Programme (Nairobi, 1-3 August 1990) by its Decision SS II/8 on the situation in the Middle East expressed its concern over the resulting destruction of the environment and disruption of social and economic structures.

2. On 28 January 1991, the Executive Director of UNEP expressed his deep concern over the actual and potentially dangerous effects of the war, and took the initiative to intensify co-operation within the UN system to optimize the diverse capabilities of the system to respond rapidly to urgent requests from all Member States, both those who are or could become victims and those who wished to provide assistance.

3. To set this process in motion, UNEP immediately got in touch with all governments concerned as well as with other UN agencies, especially in the first instance with the International Maritime Organizations (IMO), which had already initiated actions to assist Member States of the region in their response to the then reported massive releases of oil into the ROPME Sea Area.

4. UNEP, cognizant of the immediate and long-term environmental threats to an ecologically fragile region that supports some ten million people, convened the First UN Inter-agency Consultation on the Environmental Consequences of the War (Geneva, 5-6 February 1991). At the above consultation, the need was recognized for a comprehensive and co-ordinated approach to deal with the potential local and regional environmental and socio-economic consequences of the war, affecting the terrestrial, coastal and marine environments, as well as the atmosphere and human health.

5. The urgent need was also expressed for the support of the Kuwait Action Plan through the revitalization of the Regional Organization for the Protection of the Marine Environment (ROPME) UNEP was recognized by the meeting as having the lead role in the revitalization of ROPME, and UNEP was requested to develop a framework of action for the region. The UNEP framework of action, presented at the meeting of technical experts of ROPME on the oil spill (Bahrain, 26-27 February 1991) was recommended as the basis for a long-term plan of action. Within this framework, an integrated plan of action was developed to address the consequences of the environmental damage caused by hostilities in the ROPME region.

6. Pursuant to the above initiatives, and in conformity with UNEP's co-ordinating and catalytic role, UNEP developed a draft plan of action for the mitigation and rehabilitation of the environment in the Kuwait Action Plan region. This draft plan of action was presented to the Second UN Inter-agency Consultation* (Geneva, 15 March 1991), where it was discussed and approved by all agencies represented at the consultation. It envisages the placement, by mid-April 1991, of a Task Team Core Group in Kuwait and completion of at least the high priority surveys, assessments, and action plan designs within ninety days thereof.

---

*UN agencies and other bodies represented at the two Geneva UN Inter-agency Consultations were: FAO, IAEA, IMO, IOC/UNESCO, UNCED, UNDP, UNDRO, UNEP, WHO and WMO. The following units within UNEP were represented: the Global Environment Monitoring System Programme Activity Centre (GEMS/PAC), Industry and Environmental Office (IEO), International Register for Potentially Toxic Chemicals Programme Activity Centre (IRPTC/PAC), Co-ordinating Unit for the Mediterranean Action Plan (MEDU) and the Oceans and Coastal Areas Programme Activity Centre (OCA/PAC). Other organizations represented were: the World Conservation Union (IUCN) and the Regional Organization for the Protection of the Marine Environment (ROPME) Other UN agencies and organizations invited but unable to attend have been kept up-to-date on the results of the consultation.

THE UN INTER-AGENCY PLAN OF ACTION FOR THE ROPME REGION

7. The Plan of Action consists of three distinct phases: the survey phase, the assessment phase and the plan design phase. Its focus is on four separate but interlinked areas: the coastal and marine environment, the atmosphere, inland terrestrial areas, and hazardous wastes (Figure 1 and Table 1). Of crucial importance to the success of the Plan of Action is the establishment of a multi-disciplinary data-base.

8. The activities proposed under the UN Inter-agency Plan of Action are to be carried out under UNEP's overall co-ordination and in concert with the co-operating UN agencies and organizations, governments of the region, and governments providing assistance. Every effort will be made to build on data and information already generated by teams operating in the area, and on initiatives and actions being undertaken by various agencies, organizations and institutions working in the region.

UNEP's Technical Co-operation Trust Fund

9. An estimated budget of between US$ 3.0 million and US$ 3.5 million is required for the implementation of the Plan of Action on the basis of the calculated number of person-months, equipment, etc. needed for the Plan of Action.

10. Coinciding with both the Second UN Inter-agency Consultation and the Informal Ministerial Consultation held in Nairobi (March 11-13), UNEP's Executive Director established a Special Trust Fund devoted exclusively to the financing of the UN Inter-agency Plan of Action (excepting the activities by IMO which are funded by a special IMO Persian Gulf Oil Pollution Disaster Fund).

11. As of 4 June 1991, a total of US$ 2.6 million has been received in the trust fund from the governments of Japan, Norway and the Netherlands as follows:

Japan (general purposes)	US$ 1.11 million (received)
Netherlands (computerized data-system)	US$ 0.5 million (pledged)
Norway (atmospheric components)	US$ 1.0 million (received)

12. Further funding for the implementation of the Plan of Action and the comprehensive environmental rehabilitation programme would have to be mobilized from funding agencies (e.g. UNDP), donor countries and non-governmental and private institutions. This would be in addition to the above-mentioned fund established by the Secretary General of IMO. There is also a need for the establishment of an innovative global mechanism, with appropriate funding, for emergency response and rehabilitation in case of environmental disasters of regional or global scale.

Expected results of UN Inter-Agency effort by mid August 1991

13. The UN Inter-agency Plan of Action is expected to yield the following main results:

- environmental base-line information
- magnitude of impact on differenct aspects of the environment (coastal and marine, atmospheric, terrestrial, hazardous waste)
- identification of priority areas at risk
- identification of resources threatened in these areas
- multi-disciplinary operational data-base suitable for use in ROPME and any other region world-wide in case of environmental crises in the future
- trained personnel to operate data-system in ROPME area
- plans for the mitigation and rehabilitation of impacted areas
- information on possible leakage of chemical/biological/nuclear material from plants reported as damaged

PROGRESS ACHIEVED

The following is a brief description of the main achievements of the Plan of Action to date:

14. A Core Group for the Plan of Action, consisting of a Task Team Leader, a Technical Advisor (expert in Computerized Data Systems), Adminstrator and three experts from the ROPME region in the fields of marine pollution, atmospheric pollution and remote sensing, was established in Kuwait on 24 April 1991. The Core Group is hosted by ROPME and is based at the offices of the Secretariat of ROPME. The main task of the Core Group is to co-ordinate the activities to be carried out under the UN Inter-agency Plan of Action, and to facilitate the work of the experts/consultants assigned by the co-operating agencies to undertake specific tasks in Kuwait in the framework of the Plan of Action.

15. Under Memoranda of Understanding, agreements were reached with the following co-operating agencies: IOC, WHO, WMO, IAEA and UNCHS (HABITAT), outlining the areas of co-operation, the co-operative arrangements, responsibilities and terms of reference for each agency. A similar Memorandum of Understanding was signed between UNEP and ROPME. Further memoranda with other agencies are being negotiated.

16. To date IOC, WMO, WHO, IUCN and WWF have sent some 12 experts and consultants to the region either as exploratory and fact-finding missions or for data and information gathering. The Team Leader of the Core Group is liaising with the UN experts and consultants arriving in Kuwait. The agencies indicated their plans to send a further 35 experts/consultants to work on various aspects of the Plan of Action. In addition, IMO has been sending and will continue to send separately, but in co-ordination with UNEP, several experts to the region to deal with its component of the Plan of Action.

17. Data and information provided by the agencies to the Core Group have been compiled by the Technical Advisor for eventual entry into the computerized data system of the Plan of Action as soon as it is established and becomes operational in Kuwait. In the meantime, an agreement has been reached with a Dutch combination of specialized institutions in the Netherlands under the co-ordination, general performance supervision and support of the Netherlands Ministry of Environment, to establish and operate the computerized data system (CDS). The CDS will be able to handle multidisciplinary data entries effectively, and will be freely accessible to all those participating in and contributing to the Plan of Action.

18. An agreement was also reached with the Government of Canada concerning the use of an aircraft (Falcon 20) with remote-sensing capabilities to fly over the coast and part of the terrestrial plain of Kuwait and Saudi Arabia (20 hours flight time) to collect and provide high-resolution environmental information. The results of the overflights will be used by all parties involved in the Plan of Action as base-line data. Overflights were completed over Kuwait, Saudi Arabia, Bahrain and Qatar by 31 May 1991. According to a preliminary report by the Operation Manager of the aircraft, quality data was recorded pertaining to coastal areas and oil fires.

19. Air pollution in Kuwait has been monitored by various teams at ground level and in upper layers to determine the nature and fate of emissions and levels of contaminants. Data collected will be made available and stored in the data system for eventual use by all interested parties in the Plan of Action.

20. Oil pollution in the marine environment of Kuwait and Saudi Arabia and its effects on the coastal and marine ecosystems are now being checked and evaluated with IOC and IUCN taking the lead role in this respect. Further investigations of the reported oil spill at Al-Bakr Oil field in Iraq are being arranged.

21. In the context of the UN Inter-agency Plan of Action in the ROPME Region, arrangements are underway to launch a mission to other affected and/or threatened regions to lay the groundwork for the eventual expansion of the Inter-agency activities beyond the present concentration areas in Kuwait and Saudi Arabia.

FIGURE 1

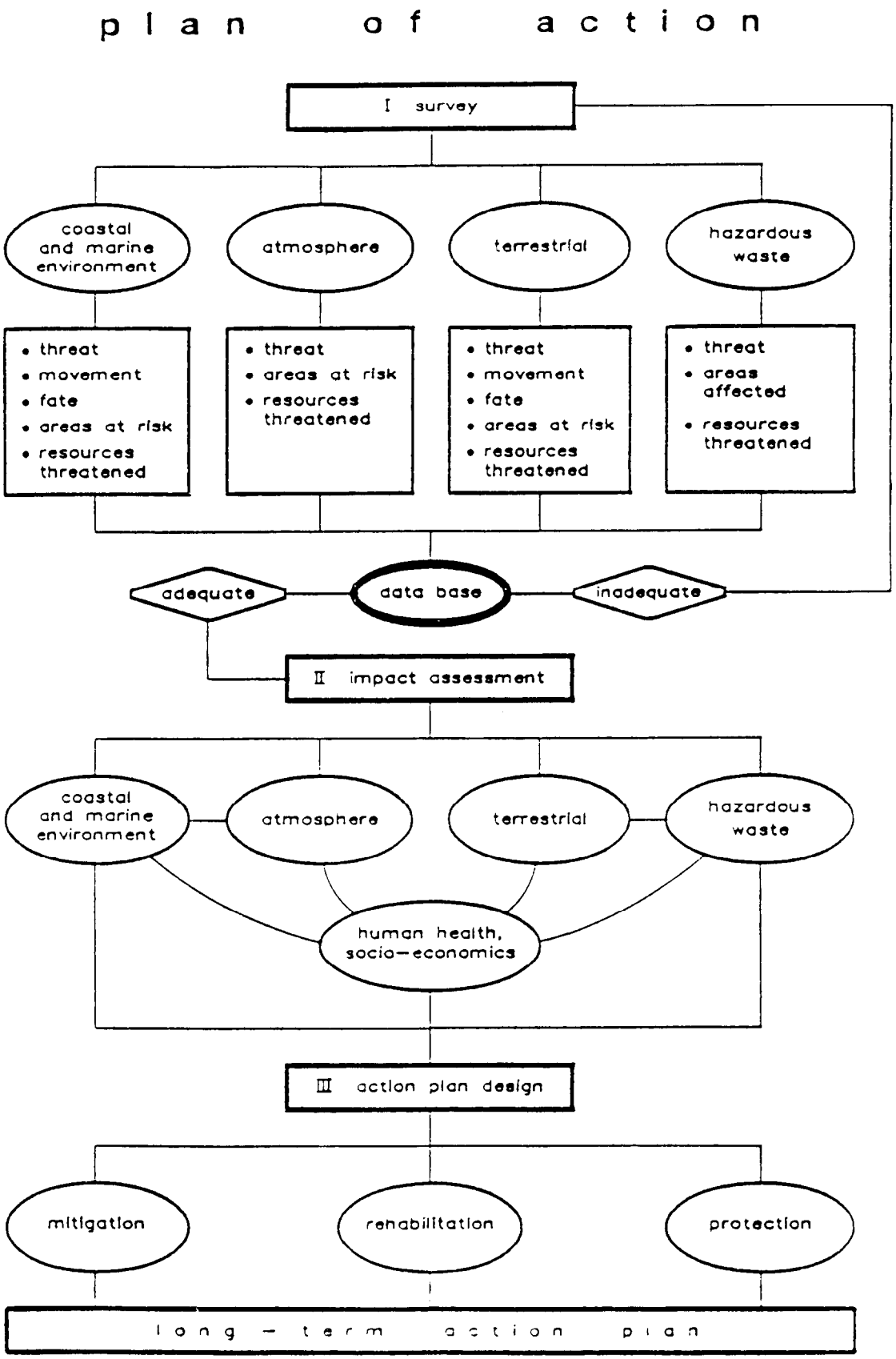

plan of action
I survey
coastal and marine environment
atmosphere
terrestrial
hazardous waste
• threat
• movement
• fate
• areas at risk
• resources threatened
• threat
• areas at risk
• resources threatened
• threat
• movement
• fate
• areas at risk
• resources threatened
• threat
• areas affected
• resources threatened
adequate
data base
inadequate
II impact assessment
coastal and marine environment
atmosphere
terrestrial
hazardous waste
human health, socio-economics
III action plan design
mitigation
renabilitation
protection
long - term action plan

TABLE 1

The following components of the plan of action are distinguished, with the responsible organizations and the immediate manpower required:

a. Coastal & marine environment:

	Organization	Person months
Oil pollution - response	IMO	*
Oil pollution assessment and monitoring	IOC/ILMR **	4
Oceanographic data support	ROPME/IOC	3
Coastal/marine ecosystem	IUCN/WWF/IOC	5
Living marine resources	IUCN/FAO/IOC	8 [add FAO]
Fishing and aquaculture management	FAO	9 [add FAO]
Coastal infrastructure	HABITAT	***
Remote sensing/data base support	ROPME/GRID	4

b. Atmosphere:

	Organization	Person months
Air quality	WMO/WHO/ILMR	6
Air-sea exchange	IOC	3
Meteorology and long-range transport	WMO	6

c. Terrestrial:

	Organization	Person months
Food, soil, agriculture	FAO/ILMR	6 (add FAO)
Food safety, drinking water	WHO	6
Solid, liquid waste management	WHO	4
Desalination	UNDP/UNEP(IEO)	3
Desertification	UNEP/HABITAT	4
Shelter/welfare	HABITAT/UNICEF/WHO	4
Industrial safety	IEO/ILO	3

d. Hazardous waste management	WHO/UNIDO/UNEP(IEO) IRPTC	3

* Oil Pollution Response: IMO is co-ordinating international assistance and has established a Gulf Oil Pollution Disaster Fund The purpose of the Fund is to facilitate the rapid deployment of equipment and services to fill deficiencies in existing efforts under way; to combat the oil pollution disaster; and provide a framework which will enable support of co-ordination efforts being made under the auspices of IMO In this context it was noted that the Executive Director of UNEP has been informed by the Deputy Chairman of the State Committee for Hydrometeorology in the Soviet Union, Professor V. Zakharov, that the Committee is willing to contribute a model for the assessment of the size, thickness, and shape of the oil in the water.

** ILMR = The marine laboratory of IAEA in Monaco, which also acts as a specialist centre for the provision of technical support on marine pollution assessments for UNEP's OCA/PAC.

*** This work should be coordinated with extensive on-going actions carried out by the United States Army Corps of Engineers.

ANNEX V

ENVIRONMENTAL AND HEALTH IMPACT OF OIL BURNING IN THE KUWAITI OIL FIELDS: PRELIMINARY ASSESSMENT

by
Saudi Arabian Delegation

SUMMARY

Just before the Gulf War was concluded in early March 1991, more than 600 wells in Kuwaiti oil-fields were set on fire causing a monstrous atmospheric catastrophe. Although there is no definite value of the amount of oil being burned, various sources estimate that 2 to 6 million barrels per day (b/d) of oil are being wasted. Before the invasion, Kuwait had 1.8 million b/d production and 2.5 million b/d capacity. Considering the current price of crude oil as 20 US dollars per barrel, it is estimated that about 35 billion US dollars worth of oil will be wasted by the time the fires are completely extinguished (approximately two years), which may reduce Kuwaiti's oil reserves by 3 to 5%

Scientists have cautioned about the global effects of the fires due to the 'self-lofting' mechanism which may cause smoke and surrounding air to rise to the stratosphere. These views, however, have not yet been confirmed. Environmentalists have also presented their estimates on the extent and size of the smoke pollution, thermal heat radiation, and the environmental impact assessment. Recently in the World Meteorological Organization (WMO) meeting in Geneva discussions took place about the regional and global impact of the pollutants on the monsoon, extensive damage to the vegetation and the ecosystem, and climatic changes. It has been reported that the impact of these pollutants on human health, vegetation, and the ecosystem may extend thousands of kilometers from the source.

In the beginning of May 1991, atmospheric scientists in Hawaii reported that particles of carbon soot in the air were 20 times above the average level. The black rain in Kashmir and traces of Kuwait oil soots in the USSR are also indications that the environmental disaster from Kuwaiti oil burning is also reaching thousands of

kilometers beyond Kuwait's borders. Researcher still have very little information about the composition of the smoke, its areal extent, its rise in the atmosphere, particle size distribution, associated gases, and unknown organic constituents. To collect some of the needed information, measurements using air crafts are being carried out by various countries including the USA, Germany, the United Kingdom, and the USSR.

A more pressing worry of the people in the Gulf region is the unknown effects of the smoke and ash which darken Kuwait and bordering cities even in mid day . There are unburned and partially burned constituents in the smoke, the impacts of which are still not known to the scientific community. A coating of oil mist on the leaves of vegetation may deprive them from the needed sunlight. The atmospheric fallout on the Arabian Gulf may pose a further threat to the marine habitats and the marine ecosystem. The unknown constituents in the soot and other fallout enter air passages and lungs of animals. Blackened lungs of slaughtered animals and change in color of fur of sheep are causing concern about the effects of soot and inhalable particulates on human beings.

Burning wells in Kuwait are producing large amounts of gases such as sulfur dioxide, carbon monoxide, hydrogen sulfide, carbon dioxide, and oxides of nitrogen as well as particulates containing partially burned hydrocarbons and metals. All of these substances have a potential for affecting human health and vegetation growth. Particularly harmful gases are sulfur dioxide and the nitrogen oxides. Photochemical reactions between the nitrogen oxides and hydrocarbons produce oxidants of secondary pollutants which may also affect vegetation.

In order to assess the environmental impact of burning oil wells, both modelling and monitoring programs have been initiated by the Research Institute at King Fahd University of Petroleum and Minerals (KFUPM/RI). The Institute, in addition to its own monitoring program, has also been compiling ambient air pollution data from various sources such as Saudi Aramco, the Royal Commission for Jubail and Yanbu, and the Meteorology and Environmental Protection Administration (MEPA).

Based on the processed information from satellite imagery, the number of burning oil wells and their locations in different oil-fields have now been identified. Knowing the productivity index of wells, an estimate was made of the amount of escaping oil and associated gases on a daily basis. It is estimated that approximately 2.5 million barrels crude oil and 35 million cubic meters of associated gases are burning each day

emitting approximately 20,000 tons of sulfur dioxide (SO_2), 1500 tons of particulates, 250 tons of carbon monoxide (CO) and 500 tons of oxides of nitrogen (NOx) to the atmosphere on a daily basis. In addition to the above gases, tons of toxic metals and carcinogenic elements are also being released into the atmosphere.

Data on the total suspended particulates (TSP) using high volume samplers and on inhalable particulates using PM-10 samplers are being collected at various locations in the Eastern Province of Saudi Arabia. These filters are analyzed for toxic metal concentration and oil hydrocarbons, including some carcinogenic organic compounds.

Soil samples have also been collected from different locations and have been analyzed for nickel and vanadium. The results indicate that the concentration of metals decreased with an increase in the distance from the Kuwait border. Kuwaiti crude oil contains 10 mg/kg and 30 mg/kg of nickel and vanadium respectively. Atmospheric fallout from the burning Kuwait oil fields seem responsible for the observed distance-metal concentration correlation.

Real time measurements of various gaseous pollutants in the ambient air are being carried out on a continuous basis in Dhahran, Abqaiq, Rahimah, Jubail, and Tanajib. By analyzing the measured values at these locations, no significant impact of the burning of oil wells has been observed in these areas. However, the inhalable particulates concentration has been found to be relatively high. The levels of the typical pollutants such as sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) found in the ambient air are much lower than the permissible limits defined in the MEPA standard.

The inhalable particulates measured using PM-10 samplers were higher than the MEPA limits, especially during those days when prevailing wind direction has been north-westerly. It is worth mentioning that high concentrations of total suspended particulates in the air are not uncommon in this region during the 'shimal' season in previous years.

In order to assess the impact of burning oil wells, computer modeling activity has also been initiated. A number of available air pollution modelling packages were reviewed. The following two types of air pollution modeling packages are currently being used by the Research Institute:

A- UNAMAP's RAM MODEL: The Institute has applied RAM (a multiple-point and area-source algorithm), a software within Users' Network for Applied Modeling (UNAMAP), to assess the impact of burning oil wells in Kuwait. This package requires surface meteorological data on wind speed and direction, temperature, mixing height, and stability classes on an hourly basis.

B: ARL-ATAD MODEL: To trace the movement of the plume from burning sites and also to estimate concentration and deposition of pollutants on a regional basis (within and outside of the Kingdom), KFUPM/RI is using another package called Air Resources Laboratory, Air Transport and Dispersion Model (ARL - ATAD). This model generates long duration trajectories of a plume originating from a number of sources. Each trajectory is calculated using transport winds averaged in a vertical layer. Dispersion calculations are also made from these trajectories. Time averaged surface air concentration and deposition amounts can also be calculated and mapped.

The U.S Air team in collaboration with MEPA and KFUPM/RI have developed a plan entitled *'Gulf Regional Air Monitoring Program(GRAMP)'*. Parts of this plan have been initiated, specifically the implementation of PM-10 filter processing and analysis, development of a database, and an interlaboratory performance evaluation. Communications links have been established among national organizations such as MEPA, KFUPM, and Saudi Aramco.

In order to assess the impact of pollutants on human health, an action plan is being formulated with the following major tasks:

Initiation of Health Alert System: This system is planned to inform the "Air Pollution Crisis Response Committee" about potentially dangerous concentrations of pollutants through electronically transmitted reports. The information will include measured and estimated values of the primary pollutants including concentrations measured using TSP and PM-10 monitors. The measured information will then be compared with a Pollutant Standard Index as recommended by EPA to define the extent of alert in different regions.

Advice to Physicians Regarding Environmental Health Concerns: It is planned to distribute one or two page documents describing the known health effects, the symptoms, the complications and the management of diseases associated with each of the major pollutants. A public awareness program describing the potential health

hazards and preventive measures has also been planned. These will be distributed to clinics, schools and hospitals, and other health centers.

Collection of Mortality Data: A questionnaire is being designed to collect data from various primary health units. The collected data will be stored in a database. The information thus obtained will be compared later with statistics of previous years.

Long-term Impact Studies: It is planned to collect smoke aerosol data and assess the genotoxic and mutagenic potential in human cells. On this activity, the experience of the School of Public Health at Harvard University will be utilized.

In order to characterize smoke dispersion and the constituents in the smoke with time and distance from the source, many international organizations have initiated measurement programs which have been endorsed by the WMO. These organizations include the Royal Meteorological Society of the UK, the National Center for Atmospheric Research in Colorado (USA) and teams from the University of Washington in Seattle (USA) and Germany. The Soviet Union is also planning to send a team to collaborate on the collection of areal smoke data. The US Air team has installed towers near the source for the meteorological data collection and also to study wind circulation around the burning oil wells. It has been agreed that all the above organizations will share data collected with MEPA and which will finally be stored in the database being currently developed by KFUPM/RI.

ANNEX VI

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
Unesco, Paris, 12 - 14 June 1991

REPORT OF IOC MISSION TO THE ROPME SEA AREA

(Bahrain, Kuwait and Saudi Arabia)
April-May 1991

by

Olof Lindén and Arne Jernelöv

1. Background

The Sixteenth Session of the IOC Assembly adopted in March 1991 Resolution XVI-14 on Oceanographic Cooperation within ROPME Sea Area. Meanwhile an interagency consultation on the environmental consequences of the Gulf War oil spill and oil fires were held in Geneva in March 1991. As an outcome of that consultation UNEP prepared an action plan with input from other UN-agencies. IOC offered its assistance to the action plan in the areas of its competence, i.e. covering physical oceanography, marine chemistry and marine biology. A group of experts forming the IOC Task Team covering these areas have been identified. In order to assess the situation before further action by the task team, a reconnaissance survey covering Bahrain, Saudi Arabia and Kuwait was carried out during the period April 24 to May 8. The outcome of this survey is reported here. The survey was financed by the Swedish Ministry of Foreign Affairs through the Swedish Agency for International Technical and Economic Cooperation (BITS).

2. IOC Reconnaissance Survey

The primary objective of the IOC Task Team is to assess the ecological effects of the oil spill. The basic approach involves an intensive short-term program and a more limited scale long-term program.

The objective of the reconnaissance survey was to assess the feasibility of initiating the work of the IOC Task Team. Thus, the extent of the oil pollution in the marine environment was surveyed in the different countries affected. Also, the need for, and possibilities to, carry out field and laboratory work were assessed. In addition ongoing similar activities carried out in the different countries were looked into.

3. History of the Gulf war oil spills

The Gulf war oil spills started on January 19 when Iraq started pumping oil from five tankers moored near the Mina Al Ahmadi oil terminal. The quantity of oil released into the Gulf from these tankers could be up to 500.000 tons according to U.S. Department of Defence. A second spill started around January 20, when the pipelines on the Sea Island terminal about 12 km off-shore from the Mina Al

Ahmadi oil terminal, were opened. Oil continued to spill into the Gulf from these pipelines until January 26, when U.S. aircraft destroyed manifolds that controlled the oil flow to the terminal from storage tanks located 5 miles inland. The quantity of oil released from the Sea Island terminal remains unknown but estimates have ranged from 100.000 tons (U.K. experts) to 1 million tons (Saudi Arabian Ministry of Petroleum). Another major spill was reported around January 30. This spill originated from the oil terminal at Mina Al-Bakr in Iraq, but its size is unknown. In addition to these spills, a number of other spills have occurred during the war which have affected the Gulf. Thus, spills have occurred from several of the oil terminals and refineries along the coast, for example the Al Ahmadi and Shuaiba in Kuwait, the Basra oil refinery at the mouth of the Euphrates River and the Ras Al Khafji oil storage facilities in Saudi Arabia. Also, spills have occurred from a number of ships, including two tankers that have stranded along the north-eastern coast of Bubiyan Island. Spills of oil into the Gulf has also taken place from oil filled trenches which were parts of the Iraq defence. Such trenches were dug along the coast for example at the Subiya peninsula north of Kuwait Bay.

4. Observations

4.1 Field

In Kuwait

As described above, massive amounts of oil were released during the war from an off-shore oil loading terminal ("Sea Island") on an artificial island off Mina Ahmadi oil refinery. The terminal is supplied by a pipeline from oil storage facilities on land). This oil together with oil from five oil tankers off Mina Ahmadi, which also was released during the same period was brought to sea by currents and winds. Much of this oil ultimately stranded in Saudi Arabia. Very little of it arrived at the coast of Kuwait.

At Ras Subiya at the peninsula north of the Bay of Kuwait, five oil pipelines where completed and several more under construction as part of the Iraqi defence system. Extensive oil filled trenches were also constituents of the fortification system. Large volumes of crude oil had escaped these trenches during high tide and contaminated the shoreline of the peninsula itself, the northern shores of the Failaka Island and possibly also the southern and eastern shores of Bubiyan Island. Here some of the oil stranded during extreme high tide as was obvious from its presence high up in the salt marshes. Two stranded oil tankers were

present in the ship channel north-east of Bubiyan Island. The stranded oil on the island could also have originated from these tankers.

By the time of the present mission, patches of oil mixed with sand, frequently several decimetres thick, with hard surface were present on the beaches. The oil patches frequently had a size of up to a few square meters in size. Most of the oil patches were, however, much smaller.

Due to the relatively hard surface of the oil patches, birds and crabs moved around on top of the oil, seemingly unaffected by its presence. During high tide, much of the stranded oil had adhered to the substrate. Fishes (mainly Mugil sp.) appeared in large numbers, also in areas where oil was present. Under the hard surface, the oil patches still contained viscous and sticky oil but without much smell.

A number of fresh oil slicks were observed during the overflights along the coast. One of the slicks originated in the Shuaiba harbour. Here continuous leakage from damaged oil storage tanks had been reported e.g. by the Kuwait Environment Action Team on April 27. Other slicks further out at sea were not traced its sources. Large areas of the sea was covered with a rainbow sheen.

During ground surveys carried out during the present mission along beaches south of Kuwait City, large belts of soot was observed, covering extensive areas of the sea surface. Such belts were found to have reached the shores from Ras az Zamr to Mina Abdulla. The color of these belts of soot was darker than oil and there was no smell of oil. The soot most likely originated from the burning oil wells, and particularly during relatively calm days the soot would accumulated on the sea surface. Waves, currents and winds then tended to concentrate the soot into belts, much the same way as it does with pollen or "blooming" algae in other parts of the world.

During a ground surveys thicker layers of oil were observed in certain areas, such as close to the fishmarket in Fahaheel and in the Bay of Kuwait near KISR (Kuwait Institute of Scientific Research). In several areas dead and living sea birds and waders were noted. Fish (mainly mullets) were commonly seen in shallow waters along the coast. Along the shoreline south of Kuwait City fishes, crabs and barnacles were observed in numbers as were gulls.

In Saudi Arabia

In early May at the time of the present mission the entire coast line of Saudi

Arabia from the boarder with Kuwait to Jubail was to varying degree affected by oil spills. Some areas had only suffered slight contamination while other areas were heavily impacted, particularly in the areas of Saffaniyah, the shallow bays and estuaries of Tanaqib, Dawhat Bilbul, Dawhat Munifaha and in the estuaries between Ras az Zawr and Abu Ali Island. Most of the oil that was observed in early May had arrived several weeks or months earlier, and was now in a very thick form with blackish color. Most of this oil had dried out during low tide and adhered to the bottom in the intertidal zone. During high tide, this oil was submerged under the surface.

However, also at the time of the present mission, new oil spills arrived to the Saudi Arabian coastline. During overflights on May 8, oil that appeared to be fresh had recently contaminated the estuaries of Tanaqib, Bilbul and Munifah. Oil slicks were also moving from north to south along the coast, a few kilometres south of the Kuwait boarder. Small slicks were observed south of Dawhat Munifah and Abu Island. The entire area between Jubail and the boarder with Kuwait was covered with a sheen of varying thickness from a very thin rainbow sheen to thicker layers and small oil patches.

As mentioned above the oil spill had impacted protected areas of the coast such as shallow bays and estuaries in particular. As a consequence areas of salt marsh and mangroves had been contaminated. In certain areas such as Gurman Island with stands of mangroves, clean-up efforts were concentrated on attempts to clean the oil from these areas using water flushing. The small islands of Harqus, Karan and Kurayn had reportedly all been heavily contaminated, but at least Karan Island, which is a well-known site for turtle hatching, had been cleaned completely from oil.

The drifting oil spills themselves were reported not to have affected the fisheries in any major way. It should be pointed out, however, that the most of the fisheries had been stopped during the war. Fixed fish traps in the intertidal zone had, however, been affected by drifting oil. The oil clogs the mesh and the fish traps collapse because of the pressure of the tide water.

The total amount of oil that had been collected until the first week of May, was estimated at some 1.3 million barrels. It was estimated that a similar amount was still left in coastal waters and on beaches in Saudi Arabia. Based on an assumption that at least 50% of the oil would have evaporated before it arrived to the coasts of Saudi Arabia, and that other processes such as emulsification, degradation etc. would have decreased the amount further, it can be estimated

that the total spill probably was at least in the order of some 5 million barrels.

4.2 Institutional

As a consequence of damage and pillage during the occupation and the war much of the scientific infrastructure is not or only barely functioning in Kuwait. Scientific institutions like KISR had all equipment and library removed,and some of the buildings destroyed. The staff is presently scattered over the world. For Kuwait University the situation was much the same with the exception that buildings were largely intact.

The scientists remaining in the country and working with environmental tasks had formed an organization called the Kuwait Environmental Action Team - an organization with the objectives of stimulating scientific and environmental research to assess the damage to the environment human health due to the occupation and war. Because of lack of suitable office facilities,. the Kuwait Environmental Action Team had its office in a room at the Kuwait International Hotel. The rents were paid by the government. Kuwait Environmental Action Team had access to vehicles and could arrange helicopter flights through the Kuwait Air Force. The group consisted of several competent and knowledgeable persons.

The UNEP coordinator had just arrived and was lacking even a car for transportation. ROPME was just in the process of moving back to Kuwait from Bahrain.

The UN Peacekeeping Forces arrived to Kuwait during our presence on mission. .Through the assistance of the Swedish ambassador to Kuwait, Mr. I. Kiesow, the IOC-mission was provided both ground and air transportation by the UN Peacekeeping Forces. Ground transportation was also provided by the Swedish Embassy.

Mines in large numbers on beaches and in the water together with barb-wire and other obstacles caused severe problems and prevented any extended field investigations.

5. Proposed follow up action

5.1 General

The following is a general list of biological and chemical investigations that would provide different parts of the information required for an assessment of the ecological impact of the Gulf war oil spills.

1. Analyses of petroleum hydrocarbons to establish post-war levels in sediments and oysters for comparision with pre-war concentrations and with the levels in the future.

2. Biological investigations of the fauna in mud flats, marshes, mangroves, sea grass beds and coral reefs. The ecosystems are chosen to represent both those that due to size and productivity are the most important in the Gulf area and those that due to their unique nature and rare presence require special protection. Comparisons are to be made with historic and future data and with those from ecosystems with a different degree of oil exposure.

3. Recovery of vegetation in salt-marshes, mangrove swamps and seagrass beds. These studies differ from those above not only because they deal with flora instead of fauna but also because they are concerned with the number and health of the dominating group(s) rather than with diversity. Obviously, the initial selection will identify damaged ecosystem which will be followed over a period of time. These investigations form the bases for investigations dealing with effects of clean-up and for the control of methods to accelerate recovery.

4. Collection of statistics for fish and shellfish catches for identification of discontinuities in trends that could be caused by oil pollution. This work should be done in cooperation with FAO and National Authorities.

5. The occurrence of fish parasites is frequently thought to be associated with the general health and resistance status of the fishes. Pollution stress could thus result in an increase in fish parasite occurrence. Two groups of parasites are of special interest: helminths (worms) and crustaceans.

6. Inventories of nesting birds by species and numbers. The best accuracy can often be obtained with coloni-nesting birds. The aim of the study is to follow the long-term development of the colonies that have suffered from oil damage. Where pre-war figures are available also the direct impact on the population can be assessed.

7. The number of nests and the hatching success of turtles can be used to evaluate the status of the turtle population, in much the same way as described above for birds.

8. Manatees are an endangered type of mammal where all types of additional stress - including oil - could be fatal. Inventories of number of individuals would give a bases for decision if additional protection is required.

9. Studies of effectiveness and environmental effects of clean-up techniques in the form of recovery of vegetation on salt-marshes, seagrass beds and mangrove stands in relation to clean-up methods.

Studies of methods to accelerate recovery.

10. Effects of transplantation of vegetation on marshes, seagrass beds and mangroves.

11. Effects of bioremediation techniques. If nutrients or other substances are added in certain areas in order to enhance the microbial degradation of the oil, the effects of this should be followed 1) on the levels of petroleum hydrocarbons and 2) the effects of fauna and flora.

12. Studies of the possibility to increase survival of mangroves exposed to oil by pruning the plants. Plants frequently show a better ability to survive physical and chemical stress (e g day periods or NO_x) when foliage is reduced.

5.2 Recommendations of particular relevance to Kuwait

Before the occupation, Kuwait had an ongoing marine environment monitoring program executed executed by Kuwait Institute for Scientific Research (KISR). This program covered some 30 stations nearshore as well as off-shore. A number of chemical and biological analyses were performed, many of them directly relevant to the problem of petroleum contamination, as the country has frequently suffered from oil spills along its coast. Continued sampling and analyses along the lines of this program would provide important data for an evaluation of the effects of the present oil spill.

Special impact study programs would ideally cover the oil contaminated beaches of the islands of Failaka and Bubiyan, where sections of the shoreline free of oil, could be used as control. These programs should concentrate on the effects on the intertidal community and on the long-term fate and change in the chemical and physical properties of the stranded oil.

Off the Kuwait coast there are a few small islands surrounded by coral reefs. These coral reefs are unique because of their northly location. Much of the life on them is seasonal with a dormant winter period. Along the coast, in the sub-tidal areas, there are seagrass beds of large importance as breeding grounds for shrimp and fish. These are particularly important for their high primary productivity.

Whether either of these two ecosystems have been damaged by oil - and, if so, whether rehabilitation measures are feasible or not - could not be assessed during this mission due to the presence of various obstacles such as mines, barb-wire and spear-stars. Such an assessment should however be done as soon as circumstances permit.

Given the mines, the barb-wire and the speer-starts on the beaches and in the water it seems unpractical at this time to launch such studies. The general lack of infrastructure and scientific resources further aggravates the problem.

No special study mission of international experts is therefore recommended at this time. Support to the Kuwait Environment Action Team for sample collection - to the extent possible - and storage seems feasible. Assistance to KISR and the Kuwait University to reestablish key groups for environmental monitoring and research should also be considered.

5.3 Recommendations of particular relevance to Iran and Iraq

Unfortunately, the present mission did not have the possibility of visiting Iran and Iraq. Therefore no information from these countries can be given that is based on direct observations by the mission. Reports from Iran, however, seem to indicate that large quantities of oil originating from release from the Mina al Bakr oil refinery in Iraq have contaminated the coast. An assessment of the situation with regard to the oil contamination of the coastal areas in Iran and Iraq would therefore seem necessary. This assessment should be carried out as soon as possible.

Appendix 1

Persons met

In Bahrain

Khalid Fakhro, Environment Protection Agency
Jassim Al-Quasser, Directorate of Fisheries
Derek Brown, BAPCO
Adel Orabi, UNEP
Luciano Pizzato, Deputy, Brazilian Parliament

In Kuwait

Peter Literathy, UNEP
Badria Al-Awadi, ROPME
Habib A. Al-Baccouche, ROPME
Fernando Augusto Ferraz Muggiatti, Embassy of Brazil
Ingolf Kiesow, Embassy of Sweden
Bo Lundberg, Embassy of Sweden
Sami N. Mohammad, KISR/KEAT
Adbul Hadi Bu-Olayan,Kuwait University
Jim Logan, Earthtrust
Mohammad Salman KISR/KEAT
Ali Muhammed Khuraibet, KISR/KEAT
Fatima Abdali, KISR/KEAT
Jassim M. Al-Hassan, Kuwait University

In Saudi Arabia

Nizar Tawfiq, On- site coordinator, MEPA
Abdul-Rahman al-Shá ri, ARAMCO
Mahmoud Nowilaty, MEPA
Saud al-Satti, MEPA
Essa Engawi, MEPA
Hamdan al-Ghamdi, MEPA
Khalid Abuleif, MEPA

Khaled Al-Rasheed, MEPA
Mohammad Bakr Amin, King Fahd University of Petroleum and Minerals
Ibrahim Alam, King Fahd University of Petroleum and Minerals

Appendix 2.

Schedule for mission

April 24	Departure from Stockholm, arrival in Bahrain
April 25 - 27	Visits to MEMAC and UNEP in Bahrain. Obtain visa for Saudi Arabia
April 28	To Kuwait by car through Saudi Arabia
April 29 - May 3	Visits to ROPME, KISR Univ. of Kuwait etc. in Kuwait Visits along the coast by car and aeroplane
May 3	To Bahrain by plane
May 4 - 6	Visits to Environment, Bahrain and BAPCO. Obtain visa for Saudi Arabia
May 6 - 7	Visits to MEPA, Dharan. Visits along the coast by car and helicopter
May 8	Departure for Stockholm

ANNEX VII

LIST OF PARTICIPANTS ACCORDING TO SUB-GROUPS

CHAIRMAN: Nizar I. Tawfiq (Saudi Arabia)
VICE-CHAIRMAN: G.S. Quraishee (Pakistan)
RAPPORTEUR: M.Y. Abdulrahim (Kuwait)

Sub-groups	A	B	C	D
Discipline	CHEMISTRY	BIOLOGY	PHISICAL AND GEOLOGICAL OCEANOGRAPHY	POLICY AND INT. CO-OPERATION
Main Sub-projects	Petroleum Hydrocarbons Types, concentra-tions, fate.... etc Air/Sea Exchange	Impact Assessment on Ecosystems and Living Resources	Physical and Geological Oceanography Air/Sea Exchange	Logistics Infrastructu re Manpower Training Co-ordination Data Management Information Management
Chair-person	K. Burns	B. Bayne	E.S. Hassan	G. Quraishee
Technical Secretary	C. Ibe A. Meshal	O. Linden	V. Jivago S. Morcos G. Soares	M. Cole
Members	**A** M. Abdulrahim H. Awad K. Burns P. Chapman R. Clark A. Dabbagh A. Dahab M. de Vries J. Heintzenberg P. Michel B. Quack M.A. Sicre	**B** B. Bayne I. de Vries J. Gray J. Jaubert J. Payne A. Price G. Thayer A. Thorhaug P. Wiebe	**C** A.N. Al-Ghadhban M. El-Sayed M. Ergun A. Grotte S. Lehmann J. Piechura J. Robinson	**D** M. Behbehani A. François P. Geerders M. Gerges H. Kibby J. Knauss D. Olsen G. Quraishee H. Richer de Forges N. Tawfiq

ANNEX VIII

INTEGRATED PROJECT PLAN

BACKGROUND

Between 12 and 14 June 1991, IOC organized the first meeting of the Working Group on Oceanographic Co-operation in the ROPME Region in Unesco, Paris. This was pursuant to IOC Resolution XVI/14 which, among other things, instructed the Secretary IOC to take the initiatives in achieving operational co-ordination between agencies/countries/individuals involved in executing the coastal and marine environment components of the United Nations Inter-agency Plan of Action.

An important consideration in convening the meeting was to determine how best to use in the medium and long-term, the intergovernmental co-ordination and clearing house mechanism afforded through the existence of IOC to help secure the relevant input of the expertise and contacts available in the various IOC Programmes. This would minimise duplication of efforts, optimize output within the limited budgets available and ensure that those concerned do not fall over each other in trying to achieve similar goals.

Members of the working group include identified experts from the ROPME Region and contiguous regions, experts from countries/international organisations who have either been involved in combating the oil spill and the burning fires (and the concomitant problems) or have indicated willingness to do so and Agencies (especially UNEP, IUCN and IAEA) which are participating together with IOC in the studies of the "WET" components of the Action Plan. Two other U.N. agencies with overlapping involvements in the United Nations Inter-agency Plan of Action co-ordinated by UNEP (ie. WMO and IMO) sent contributions, in writing to the Meeting.

This Integrated Project Plan is the outcome of the deliberations of the Working Group and integrates elements of existing national plans (mainly those of Saudi Arabia, Kuwait and Qatar) designed to study the effects of the oil spill and the burning oil wells whithin their national boundaries with elements of the IOC strategy of short and long term actions addressing the pollution problem of the region. It also takes into account provisions stated in the IUCN and IAEA work programmes under the United Nations Inter-Agency Action Plan for the ROPME Region.

SCOPE OF WORK AND OBJECTIVES

The Work Plan consists of two main overlapping phases short and long-term and has a region-wide coverage.

SHORT TERM PLAN

This is geared towards gathering such information and data on matters relevant to the pollution problem that are of immediate concern to decision makers and the general public, e.g. safety and protection of seafood resources, drinking water (from desalination plants) and air. Part of its goal

is to ensure quick and appropriate mitigation and/or restoration efforts.

The broad objectives are:

(a) To establish the circulation pattern in the Gulf, particularly in the vincinity of the north western coast and the open sea area extending from the north to the southern approaches of the Strait of Hormuz and in the Strait of Hormuz itself in order to assess the distribution and dispersion of oil related pollutants.

(b) To establish a water stratification pattern in order to determine mixing processes.

(c) Quantify the extent of the oil spill inter-tidally and sub-tidally, particularly with respect to key biological habitats and resources eg.inter-tidal and sub-tidal muddy sediments, sea-grass beds, coral reefs, salt marshes, mangroves and migratory birds.

(d) Assess the levels of petroleum hydrocarbons and trace metals (especially NI,V) in the atmosphere, water column and sediments and biota.

(e) Quantify the immediate and on-going effects of oil-related pollutants through assessment of change in community structure, composition, and other appropriate chemical, biochemical, physical and ecotoxicological studies on surviving habitats and species in the affected grounds especially in fish and shrimp spawning/nursery grounds.

(f) Evaluate atmospheric deposition/fluxes (mainly dry) for combustion products (eg. SO2,NOx, total carbon, elemental carbon as bulk parameters in the atmosphere, as well as petroleum hydrocarbons (aliphatics and aromatics), and use mass balance approaches to determine air/sea interactions particularly evaporation.

LONG-TERM STUDIES

In reality, a long-term study should derive from the results of the short-term study particularly in terms of sites on which such studies should be focused. Longer-term studies should be undertaken for the purpose of fully assessing the extent of environmental injury, evaluating natural recovery processes and improving the scientific basis for future spill response. However, certain known approaches constitute the core elements of such a programme and are defined below:

(a) Establish the circulation pattern for the whole of the Gulf to understand the transport and deposition of pollutants;

(b) Evaluate the residence time of the inner Gulf in order to project rates of build-up of petroleum related pollutants in the water column and bottom sediments.

(c) Develop accurate model for atmospheric deposition and coastal/oceanic circulation, and enhance existing oil spill trajectory models, e.g. the Gulf Slick II for application in future spills.

(d) Establish the ultimate fate of the hydrocarbons and other oil related pollutants both in air and marine environment, including photo-oxidation reactions.

(e) Investigate disappearance of critical habitats as an index of long-term impact;

(f) Determine critical damage indices: disappearance of sensitive species, injury marks on corals, sublethal stress indicators in bivalves and fish and to evaluate recovery rates

(g) Quantify the sources of carbon fixation and flux.

METHODOLOGIES

The methodologies for accomplishing the objectives stated above are fairly established and most have been published under the "Reference Methods for Pollution Studies" series. Some of the methods are mentioned in the appendixes for the disciplinary components of this plan.

Most of the methodologies referred to above include suggestions as to sample collection (including density of sampling and storage prior to analysis). The correct procedures (appropriate statistical methods) must be adopted at the onset of any sampling programme in order to provide sufficient replication whilst avoiding the pitfalls of pseudo-replication. Elaborate sampling schemes (transects and locations) already exist at the national level in some countries and through previous work by IUCN, IAEA and ROPME and should be integrated into the regional sampling network.

It is important that Member States of the region conduct the sampling of their respective offshore areas at the same time so as to provide a coherent time-series for the region as a whole.

TIME FRAME

The short term plan would be executed in about 12 months or more although it is recognized that certain aspects of the plan particularly those dealing with quality of recreational waters, seafood and safety, sea water for the desalination and power plants could be accomplished, sooner than the 12 months. This is both desirable and necessary as it would provide much needed scientific basis for important social, health and economic regulations by decision makers and the adoption of certain precautionary measures by the citizens.

In principle, the long term plan could last "forever" but of course there will be need to set time limits and the Working Group considered that a three to five year period would be adequate in the first instance.

MODALITIES FOR IMPLEMENTATION

The strategy for implementation hinges on the utilisation of existing resources (human, material and financial) in the region to be supplemented by international assistance. The region boasts of high level scientists and some of the research centres (e.g The Research Institute of the King Fahd University for Petroleum and Minerals, Dhahran and the Kuwait Institut of Scientific Research before the war, as well as centres in the Islamic Republic of Iran, as well as universities in Qatar, Oman and UAE) have equipment and research facilities comparable to those in the industrialized world. Such personnel and facilities should constitute the core for implementation of region wide project.

The implication in that regional cooperation is absolutely critical. International support should aim at fostering this regional co-operation while identifying and making good the gaps in men, material and finance required for project implementation. Owing to the intergovernmental nature of the IOC, the Commission has an advantage to play the lead role in stimulating and co-ordinating such international/regional support in concert with relevant UN Agencies and national/regional/international organisations particularly ROPME, NOAA, USEPA, IFREMER, CEDRE, IOCINDIO, etc.

In this regard, the IOC should play a catalytic role to facilitate the long-term goal of a revitalizing regional infrastrucutre and network and co-ordinate the organization of oceanographic cruises and communal research project in the Gulf region at large, along the lines provided in IOC Assembly, Resolution XVI-14.

DATA MANAGEMENT

Data generated as part of this workplan should be quality controlled and adequately stored for easy retrieval by all interested parties.

Although the Inter-agency Action Plan provides for centralised data base management, the Working Group, while endorsing this approach, recommends that technological developments make it relatively easy for each country to additionally have its own data centre. Such centres, in fact, are arlready in existence in Saudi Arabia, the Islamic Republic of Iran and Kuwait.

TRAINING/EDUCATION

In the field of training and education, IOC can provide various possibilities. These include: individual training and group training, in the region or -if needed- elsewhere in a centre with a specific expertise. In such cases, IOC can arrange a contribution to the expenses of the participants and the lecturers.

Specifically, IOC effort would aim at improving capacity in the region for:

(i) handling and maintenance of specific oceanographic instruments;

(ii) management of marine data and information;

(iii) remote sensing of the marine environment.

It is understood that specific requirements exist in the Gulf Region for training/education related to instrumentation and instrument maintenance, handling of marine data and information and Remote Sensing.

Training is also needed both to improve oceanographic research capabilities and enhance spill response expertise.

BUDGET

It is not possible at the moment to give estimates of the costs of the short and long-term plans because the estimated cost of each plan would depend on how many elements are incorporated in each plan and of course on the exact duration of the plan.

Budgeting should form the subject of further work possibly at the level of a small Steering Committee.

APPENDIX A

SUB-GROUP A: CHEMISTRY

1. SUMMARY AND RECOMMENDATIONS OF THE CHEMISTRY SUB-GROUP

The Chemistry Sub-Group:

1) Recognizes the need to address "short" and "longer" term impacts and the need to monitor recovery of the marine environment in the Region.

2) Recommends that previous studies and experience within the Region should be accounted for in designing programmes of work.

3) Agrees that, in hydrocarbon evaluation, a heirarchical scheme of analytical procedures including the enumeration of tar falls, fluorescence spectrophotometry, GC-FID through to GC-MS (as detailed in the revised UNEP/IOC Manual on Monitoring of Petroleum Hydrocarbons in Sediment) should be adopted. The Group also recommended that copies of the Manual should be distributed to the ROPME Member States.

4) Recommends that laboratories in the Region which have the potential to measure relevant contaminants be appraised and then suitably upgraded and provided with training and quality assurance support through international collaboration.

5) On discussing the scientific objectives, recommends that investigations should include:

5.1 integrated chemical and coastal biological studies;

5.2 assessment of biogeochemical changes in oil residues incorporated into sensitive habitats (especially the productive muddy substrates such as mangrove, seagrass, coral reef and mud basin sediments);

5.3 water column contamination evaluation of polluted environments through analyses of filter feeding bivalves and commercial fish and shrimp species;

5.4 assessment of other potentially important pollutants released in increased quantities owing to the destruction of facilities such as sewage treatment, desalination power production and chemical plants;

6) Recommends that urgent effort be directed at identifying resources that can be adapted for use in the oceanographic studies including manned research vessels, coring devices, and other sampling gear.

2. METHODOLOGY

The need to address both short- term impact assessments and longer-term studies was recognized. The analytical methodology must be defined to address questions of biological impact and biogeochemical processes. Thus the hierarchical approach as detailed in the redrafted in the Manual on Monitoring of Petroleum Hydrocarbons in Sediments (UNEP/IOC, 1991) should be adopted. This new manual is an extension of methods specified in ROPME Monitoring Manual (MODPAM) and should be made available for distribution to all participating laboratories. The methods recommended for use in the subprojects discussed below should be extracted from the printed Manual. Thus the details will not be repeated here.

3. PETROLEUM HYDROCARBONS IN SEDIMENTS

Needs for the chemistry program were defined as follows:

In support of the coastal biology studies and to assess the biogeochemical changes in stranded oil over time, sediment samples should be collected, frozen and archived from impacted and reference study sites in accessible critical habitats. These include areas that will retain oil over long time periods (the muddy substrates in mangrove, saltmarsh, seagrass and sub-tidal mud habitats). It also includes other critical habitats such as coral reef sediments. Thought must be given to optimizing spatial coverage in study sites by compositing samples for analysis. Samples can undergo levels of analysis that are relatively inexpensive (UVF) to provide gross estimates of the extent of contamination and to address questions of sampling replication. For the direct assessment of potential toxicity and to address the biogeochemical aspects, a selected subset of samples should be carried through to gc and gc/ms analysis of specific aromatic hydrocarbons as detailed in the UNEP/IOC methods manual. The first samples should be collected as soon as possible.

4. PETROLEUM HYDROCARBONS IN BIOLOGICAL SAMPLES

To address questions on ambient water quality in coastal areas, filter feeding bivalves should be monitored on a regular basis such as quarterly. These analyses will provide a continuous "history of exposure" to organisms living in the water column. In previous monitoring efforts in the Gulf Region, rock oysters and pearl oysters have proven useful. Study areas, where a suitable native population is absent could have transplanted bivalves suspended in the coastal waters.

To address questions of toxic residues in edible species, the following strategy emerges. Fin fishes provide several levels of concern for pollutant exposure in the ROPME Sea area : concentrations of pollutants in edible tissues of concern for human health safety (consumption of seafood); and as a record of exposure history to pollution, especially for fish species which feed and live on soft bottoms (muddy substrates). Trace element analyses for nickel, vanadium, arsenic, copper, lead and mercury should be implemented (and expanded in existing programs) in edible tissues (fillets) in selected sites in impacted (and reference) areas of the ROPME area. Because

of active metabolism in fish and other higher animals, most petroleum components are discharged into the bile.

For relating exposure of fin fishes to petroleum-related aromatic compounds in the marine environment, it is desirable to employ fluorescent aromatic contaminant analyses of bile (collected from the gall bladder) and determination of the levels and activities of mixed function hepatic oxydases. Fluorescent analysis of bile using high-performance liquid chromotography (Krahn et al, 1986) provide a rapid and inexpensive method of screening fishes for exposure to aromatic contaminants. Most fishes process such contaminants and deposit the fluorescent metabolites in the gall bladder within hours of exposure. If necessary, a small percentage (10%) of edible tissue could be analyzed for selected individual parent hydrocarbons by GC/M3 quantification to show presence or absence of such components.

The cytochrome P-450 dependant mixed function oxydase (MFO) enzymatic system is implicated in the degradation of polynuclear aromatic hydrocarbons. Two methods of measuring cytochrome P-450 associated enzymes are the aryl hydrocarbon hydroxylase assay and the ethoxyresorufin - O - deethylase (EROD) assay. These catalytic assays are very sensitive and reproducible but they require extreme care in sample integrity (i.e. storage at -80 C, minimizing degradation during processing). The EROD method (Grzebyk and Galgani, 1991) has been accepted as a reference method by the International Council for the Exploration of the Sea as very simple, efficient, and cost effective. Hundred of samples can be analyzed in a few days.

For crustaceans and molluscs, no bile can be collected for analyses and since metabolic transformations are much slower in these species than in fish, they may be analyzed for parent hydrocarbons using appropriate methods.

5. AIR/SEA EXCHANGES

The need to evaluate atmospheric deposition/fluxes for combustion products and petroleum components is important in the Northern Gulf as a result of burning oil wells. Because of the low precipitation rates, wet deposition can be neglected. Dry deposition will be calculated from atmospheric concentrations and deposition velocities.

The sea-to-air exchange evaporation must be estimated, especially in areas of oil spills.

Comportments to be investigated

Particulate and vapour phase concentrations need to be determined simultaneously to ascertain evaporation and atmospheric deposition. Concentrations will be measured from high-volume sampling either on GF/F filters or quartz fiber filters. Vapour phase compounds can be collected on adsorbants such as foam plugs placed down stream of the filter.

Cascade impactor sampling is also required on a reduced number of samples, to get the particle size distribution of the compounds under investigation, in order to obtain their settling velocities and thus calculate

their deposition on the sea surface. Evaporation fluxes are needed to estimate how much petroleum hydrocarbon is leaving the marine ecosystem.

Microlayer and sub-surface samples should be collected in selected cases in connection with remote sensing data both in natural and polluted slicks. The microlayer is known to affect air/sea exchanges.

Soils where combusted products have deposited can be air transported upon storms or high wind speed. This fraction of the pyrolytic component may have different pathways in the atmosphere and water column than the submicron particles traditionally associated with combustion processes, since it involves coarse particles.

Parameters to be monitored

- SO_2, NO_x, total carbon, elemental carbon, should be measured as bulk parameters in short and long-term studies
- Pilot investigations for the long-term study
- Ni/V ratio will be used as a source indicator for oil.
- Sulfur
- Aliphatic hydrocarbons and polyaromatics plus their photochemical and microbiological degradation products have to be measured since these products can be more carcinogenic than their precursors.
- Volatile hydrocarbons are proposed as a recommendation.

Data needed from other groups

- Local wind data, humidity, temperature, etc.
- Trajectories for regional scale studies
- Wave coverage (or water surface) to assess particulate emissions from the sea surface from sea-salt aerosol formation
- Estimates of the capacity of each well

Sampling sites

- Sampling should be conducted from land-based atmospheric sampling stations at the source. (Warba and Bubian Islands).
- Other potential sites along the coast need to be identified. (Airports, islands and military basis) to look at the impact of the smoke-plume. Dust deposition rates measurements (conducted at
- the airports along the Saudi coast) may be available since 1979.
- Aerosol collection from ship is necessary if we want to assess what actually reaches the sea surface.

For larger-scale transport, sampling should be done from aircraft.

Sampling should be conducted on a daily basis for some parameters such as SO_2, NO_x, and carbon (soot and organic). For the more sophisticated, time-consuming measurements, samples would be taken on a less frequent time scale.

6. ASSESSMENT OF THE IMPACT OF BURNING OIL WELLS IN THE NORTHERN ROPME SEA AREA

The transport and fate of oil components, photo-oxidation products and burn products associated with the burning oil wells in Kuwait play a central role in the impact of this pollution in the Northern ROPME Sea Area. This problem is best addressed by employing a mass balance type model which incorporates estimates of the sources reactions, sinks and ultimate reservoirs. Processes to be investigated included riverine and other coastal inputs, atmospheric deposition, bioaccumulation by organisms, particle transport and flux, and the rates of deposition and *in situ* degradation in sediments. The approach is exemplified by Burns and Saliot (1986). The atmospheric flux rate would be estimated as detailed in Section 5 above.

Additional effort should include measuring the flux of contaminants through the water column in open sea areas and by means of large volume *in situ* sampling of suspended particles in both open sea and near coastal areas. The sea array should be planned to cover the area under the major plumes emanating from the burning wells. The water column flux should then be compared with fluxes to the sediments estimated by the analysis of interfacial and buried sediments. Visiting research vessels would be useful for collecting sediment cases in open sea areas.

It may be possible to differentiate sources of hydrocarbons and oxidation products using a principal component analysis of chemical data which includes the composition of individual aromatic hydrocarbons (parent vs substituted ring structures), the unresolved saturated hydrocarbons characteristic of unburned petroleum residues, the composition of photo-oxidation products, the composition of tri-terpane biomarkers, and the content of nickle and vanadium. Implementation of this sub-program will depend on obtaining sediment traps and *in situ* sampling devices from collaborating scientists.

7. ADDITIONAL CHEMICAL POLLUTION PROBLEMS

To address related pollution problems additional to the spilled oil, two types of sampling are envisioned.

The impact of chlorination on elevated organic content in seawater used in power and desalination plants in the region.

The discharge of detergents and sewage in areas where treatment plants are absent or have been destroyed.

Both of these would require individual efforts geared to the specific problems. They could be included in the relevant coastal assessment plans.

8. LABORATORIES, TRAINING AND INTERNATIONAL COLLABORATION.

There are several laboratories in the region with variable capabilities. These laboratories should be strengthened and upgraded to provide services to satisfy the demand of the voluminous workload required.

The Research Institute of King Fahd University of Petroleum and Minerals in Dahrahn houses an excellent capability with a track record of using sophisticated techniques. At present all samples from the Saudi Arabian waters, as well as from other surrounding areas, are being processes at this Institute. Further support is required to expand existing capability.

In Kuwait, the Ministry of Health's Laboratories are operational. Kuwait Institute for Scientific Research (KISR) has lost all its equipment. Some staff members are available and plan to build up their laboratories.

Other countries in the region have resources that vary in capability. Training is essential to upgrade these laboratories and to support the interlaboratory calibration activity. Previous experience has shown that in-house training using experts from international laboratories joined with short-duration workshops give the best results.

It is therefore recommended that chemical analysis for the coastal monitoring program be performed in the region as much as possible either through contracts with existing facilities and/or through upgrading of existing facilities and provision of extensive training programmes on site.

In order to adequately address the national as well as the regional objectives of the workplan, a dual approach is recommended. National institutes, though the National Focal Points, should receive technical and logistic support to carry out the sampling and analysis programme within their territorial waters. Emphasis would be on the specific problems and needs of the individual country while carrying out the requirements (in terms of numbers of samples, parameters and cost of procedures) of the programme. The regional component involves a joint effort of national institutes in the region, as well as other institutes and international organizations to carry out work in the open sea (i.e., the cruises). This approach has been applied by ROPME in co-ordinating the KAP Monitoring Programme and does not preclude bilateral co-operation in implementing the regional components.

9. REFERENCES

Burns, K.A. and Saliot, A. 1986. Petroleum hydrocarbons in the Mediterranean Sea: A mass balance. Marine Chemistry 20: 141-157.

Burns, K.A. 1986. Evidence for the rapid in situ oxidation rate of pollutant

hydrocarbons in the open Mediterranean. Rapp. P.-V., Reun. Cons. Int. Explor. Mer, 186 : 432-441

Grzebyk, D, and Galgani, F. 1991. Measurement of the effect of organic pollution on marine organisms: Rapid determination of EROD induction using plate readers. Aquatic Living Resources 4: 53-59

Khran, M., Moore, L.K., and MacLeod, W.D. 1986. Metabolites of aromatic compounds in fish bile. NOAA Technical Memorandum NMFS/NWC-102.

UNEP/IOC,1991. Monitoring of petroleum hydrocarbons in sediments. Reference Methods for Marine Pollution Studies. N° 20, UNEP 1991.

APPENDIX B

SUB-GROUP B: BIOLOGY

The sub-group concentrated its discussion on the following topics:

1. THE BIOLOGICAL COMPONENTS TO A MONITORING PROGRAMME

There is a spectrum of biological research and monitoring requirements which, at the extreme, can be characterised as follows:

Fundamental, process-oriented studies designed to provide insights into how the Gulf ecosystem works; without this information we can achieve, at best, only a weak predictive capability regarding the response of this system to future pollution incidents.

In this category we would include an evaluation of what biotopes are the critical ones in fixing carbon via photosynthesis (benthic systems, such as sea-grass beds, or benthic micro-algae on mudflats; or pelagic systems via the phytoplankton); what are the key features of carbon flow in the ecosystem, and what are the nodal points that are most vulnerable to anthropogenic disturbance; what are the quantitative relationships between structural (e.g. species diversity; community type) and functional (e.g. production, nutrient flux) features of the key biotopes (coral reefs, seagrass beds, mangrove and salt marsh areas, mud flats and the water column).

Monitoring studies designed to provide an objective assessment (but without predictive capability) of how various parts of the ecosystem have been impacted and to evaluate the recovery from the oil spills.

In the second category (monitoring) we include a number of techniques which are now available for biological effects measurements. In a number of recent studies suites of such techniques have proven to have a sensitivity and robustness (also a generality of application) that recommend them for deployment in the Gulf. For example, biochemical techniques (cytochrome P450, EROD activity sl; cytological techniques using bio-marshes provide information on pathological changes within seeds and tissues (fish and invertebrates). Physiological measurements of growth to quantify the integrated health of organisms; and statistical measures of community structure (benthic and pelagic) to quantify response to, and recovery from, stress).

In addition, methods of stock analysis for commercially important fish species, when coupled with biochemical and pathological monitoring techniques and measures of fecundity and reproductive success, can provide information on impact in species of direct importance to man.

In such studies account must be taken of the contaminating source and the physical properties of the environment which determine the dispersion of the pollutants and for their concentration. Good information exists for the inter-tidal distribution of the oil in the northern Gulf region, but studies

are urgently needed on the sub-tidal, offshore, distribution of the oil, both now and over time (due, perhaps, to remobilisation from the shore-line). We also emphasise the need to measure atmospheric inputs of hydrocarbons (as aerosols, particulates, soot) to the sea-surface microlayer and to the water column, with studies (eg. by sediment trapping) of the subsequent fate of the fallout from the oil fires.

2. SITES FOR BIOLOGICAL ASSESSMENT STUDIES

In selecting sites for study careful attention is necessary to ensure ecological comparability (eg. similar sediment type and salinity regime). It appears likely that such constraints make it unlikely that study sites representing "impacted" and "non-impacted" conditions in the Gulf can now be found. However, an equally viable sampling programme can be established on transects across areas of different degrees of impact, without having to find so-called "clean reference" sites. Some of the currently available statistical techniques of community analysis, for example, use inherent properties of communities (abundance/biomass distributions) to detect degrees of disturbance. These multi-variate techniques have been usefully applied to tropical ecosystems and can be deployed in the Gulf.

We recommend that sampling sites already selected in the ROPME Region be reviewed with the criteria for biological effects measurements in mind, prior to identifying a few selected areas for detailed analysis. Existing sampling schemes (eg. by IUCN) can be used to provide a general oversight of pollution impact and major features of habitat loss. New sites may need to be identified for more detailed biological analysis.

In addition to transects across area of impact, specific sites of special scientific interest need to be identified for detailed monitoring. The "transect" study at the "special sites" study will occasionally be the same (eg. mudflats and seagrass beds), but in other cases they represent different geographical coverage (eg. offshore coral reefs).

With regard to the atmospheric inputs, a wider geographical approach is appropriate. The models of fallout from the oil fires may provide some guidance in selecting a suitable area, but such an area will have to be relatively large (to accomodate spatial heterogeneity in plankton processes) and subjected to frequent surveys except for the benthic systems which may be adequately sampled twice a year.

3. SPECIES AND ECOSYSTEM COMPONENTS

The group identified a working list of species and ecosystem components for study. This includes:

(i) Shrimp and larval stages. These are species of major commercial concern and they can serve as indicators of both benthic and pelagic events. The larvae of the "temporary plankton" may be used to identify effects of warter-borne and atmospheric contaminants. The juveniles and adults are subjected to exposures on the sea bottom.

(ii) Species of flat-fish. Such species are often non-migratory and are directly exposed to contaminants within the sediments. They have proved, in other oil-impacts studies, to be good candidates for biochemical and pathological monitoring.

(iii) Species of reef-fish, particularly of commercial importance, for limited biochemical, physiological (reproductive success) and population analysis.

(iv) Species of bivalve mollusc (eg. the role of the pearl oyster), which are wellknown to be good bioaccumulators of contaminants with readily measured physiological effects.

(v) Species of key conservation interest, eg. turtles and the dugons.

(vi) Soft-sediment benthic communities on the mud flats and sea-grass beds (also the mangroves).

(vii) Coral communities

Individual corals are sensitive to pollution, responding by "bleaching" to various environmental stresses. They are also of course of fundamental value to the Gulf ecosystem. In addition, Gulf corals are known to be very close in their distribution to their thermal tolerance limits (particularly low temperatures). Given the predicted reductions in temperature in the region, resulting from the oil fires, we recommend a special study of coral thermal tolerance, limited to measures of genetic similarity with corals further south in the Gulf, and to an analysis of the historical temperature records for the region (to address the question, and predicted temperature changes within or without historical precedents).

(viii) Mangroves

Here also, as with corals, there is a concern that long-term thermal changes in the ecosystem may pose a threat to survival commensurate with the direct effects of the oil spill. Experiments on thermal tolerance should also be carried out with these species and the results used to direct management decisions on clean up. Raised temperatures under beached oil may destroy sea grasses, salt marsh and tidal flat organisms, and such effects should also be monitored.

4. METHODS TO BE EMPLOYED

In much of what we have reported, there is reference to the methods of biological analysis to be employed, eg. habitat surveys, transect studies, techniques of biological effects measurement. We make two further comments here:

(i) It is of the utmost importance that the correct statistical procedures be adopted at the outset, in planning any sampling

programme, in order to provide sufficient replication whilst avoiding the pitfalls of pseudo replication. Appropriate statistical methods are available and should be employed.

(ii) Remote sensing techniques have an important role. Satellite sensing (eg. SPOT) can give coverage to 10m scales and are invaluable in mapping habitat (and oil) distribution and chlorophyll, but they are less able to allow estimates of effects on important primary producers and their consumers. Such techniques should be supplemented with aircraft over-flights to provide smaller scale coverage, and supported by intensive ground truth and algorithm development.

In addition, we are conscious of rapid advances being made in sea-borne remote sensing techniques such as acoustic detection of plankton and sensor technology for nutrients, chlorophyll and productivity. Whereas these procedures may not have immediate relevance to an impact study they may be of fundamental significance to any longer-term oceanographic surveys of the region.

5. RESOURCES

A considerable expertise already exists in the ROPME Region but it will have to be supplemented if a full biological project is to be effected. This can best be achieved by assembling international Task Teams to work in partnership with scientists from the Region in order to transfer relevant technology and training and to put in place this various elements of the biology programme.

Three key areas were identified:

(i) Biological effects monitoring techniques, including biochemical, physiological and community ecology procedures.

(ii) Measures of production and carbon flow in key habitats, particularly the sites of primary production.

(iii) Remote sensing.

These Task Teams would spend periods of up to three weeks in the region with other frequent visits to assist in the development of the project. This effort should be complemented by appointments within the ROPME Region of middle-grade scientists who would be trained by the Task Teams and who would work within them.

6. PRIORITIES

The following priorities were identified:

(i) Quantification of the distribution and concentration of the oil both intertidally and in the nearshore subtidal, and the concentration within edible species.

(ii) The extent of oiling and damage effecting key biological habitats

and resources (e.g. intertidal and subtidal muddy sediments, seagrass beds, coral reefs, salt marshes, mangroves, and migratory birds).

(iii) The effects of atmospheric inputs and oil on shrimps, key fish species, corals and mangroves.

(iv) Quantification of the sources of carbon fixation and flux.

7. INTERACTIONS BETWEEN DISCIPLINES

There is a need for close collaboration between chemists and biologists in identifying contaminated sites and quantifying the levels of hydrocarbons and other pollutants likely to have biological effects.

Consultation with physicists and earth scientists will help to clarify the fate of oil and its constituent products which are likely to affect biological systems.

APPENDIX C

SUB-GROUP C: PHYSICAL/GEOLOGICAL OCEANOGRAPHY

C.1: PHYSICAL OCEANOGRAPHY

1. GENERAL OBJECTIVES

The general objectives of the physical oceanographic programme (nearshore and open water) are as follows:

- To investigate the oceanographic characteristics of the Region.
- To establish the broad circulation pattern of the Region in order to assess distributional and dispersion patterns of pollutants and organisms.
- To establish the residence time of the water of the Region in order to project rates of build-up of pollutants in the water column, especially oil.
- To derive predictive models for the transport and distribution of oil pollution in the Region.
- To investigate oceanography of restricted coastal areas.

2. PARAMETERS AND PRIORITY AREAS

Physical oceanographic parameters, as well as meteorological parameters are necessary not only for the understanding of physical processes, but they are the basis for understanding chemical, biological and geological phenomena.

Because of the presence of pollution now, the priority of the work should be given to the inner ROPME region. This in turn can be considered as two areas, one nearshore and the other is open water.

In both areas physical parameters will be observed. The responsibility, however will lie with different authorities, the nearshore areas will be observed by the adjacent coastal states, while the open water will be observed by multidisciplinary, multinational cruises.

To accomplish this, both the nearshore and the open area cruises will observe the following parameters at appropriate depths.

Air pressure, air temperature, humidity, wind direction and speed, clouds and rain, solar radiation, collection of airborne matter. Satellite and airbourne images of surface temperature, colour, and altimetry (sea surface elevation) waves and sea state. Inside the water column, temperature,

salinity, pH, turbidity, suspended matter, etc., according to agreements with chemists and biologists.

3. IMPACTED COASTAL AREAS

Most of the impacted coastal areas are found in the north-western part of the inner sea area. These coastal areas are known for their irregular morphology and complex dynamic systems. The local conditions influence greatly the distribution of oil. It is recommended at this stage that ROPME encourage the current research programmes carried out in its Member States, and that at a later stage, the results of these research programmes be discussed in a scientific meeting with view of complementing each other research, and gaining a wider understanding of the coastal system in the Region.

It is very desirable that a minimum research programme in coastal oceanography be agreed upon among the various research groups with the help of ROPME in order to guarantee a certain level of results. Member States could exceed this minimum level and develop more ambitious programmes.

4. THE OPEN SEA CRUISES OF THE INNER ROPME SEA AREA

The attached map and list of oceanographic stations present comprehensive programme for winter and summer cruises.

Current meter strings of 2 meters each, recording every hour, should be moored in the circled (O) eight locations in the accompanying map.

Special attention is to be paid to the Strait of Hormuz and the exchange of water across it.

5. STRAIT OF HORMUZ

Special attention is to be paid to the exchange of water across the Strait of Hormuz. The current regime in the Strait is one of the most interesting and least known oceanographic phenomenon. The proposed study requires current moorings for longer periods of time and at different seasons and under different meteorological conditions. Such programme requires the co-operation of bordering states and the support and participation of capable oceanographic institutions from outside ROPME Region.

6. RESOURCES

This plan will not be fully successful without the additional following elements:

1) Trained manpower to operate the equipment;

2) Land-based equipped laboratories;

3) Maintenance and repair workshops;

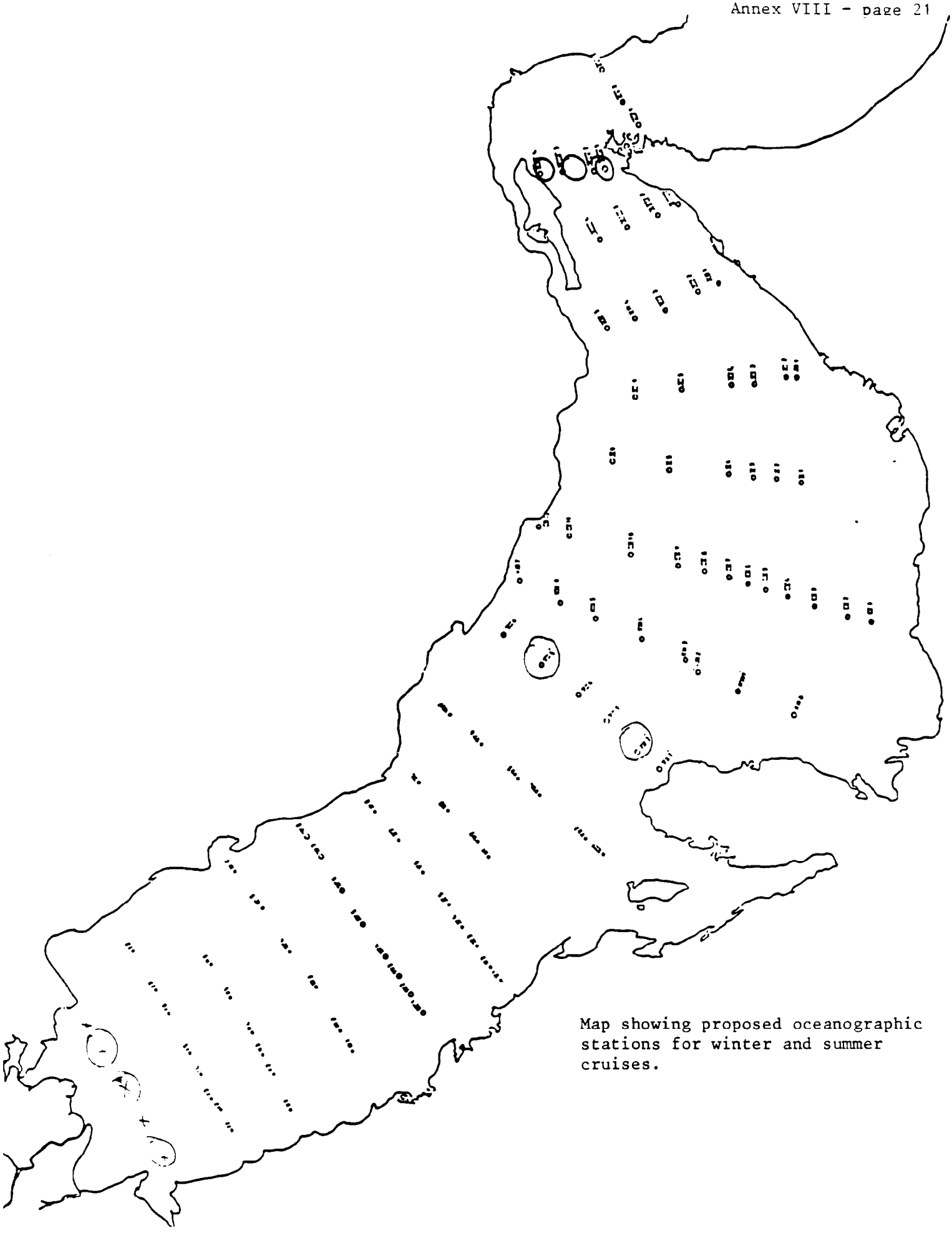
4) Freedom of movement inside the region for scientists and general availability of data for qualified experts.

This programme should be linked and coordinated with other regional and global programmes such as IOCINDIO, WOCE and TOGA and IGBP.

7. **BUDGET**

The following estimate is given for the proposed cruises only:

30 days x $ 3000 x 2 cruises	= $ 180.000/year
Initial cost for current meters 22 x 50	= $ 110.000
Initial cost for CTD, etc.	= $ 100.000
	$ 390.000



Map showing proposed oceanographic stations for winter and summer cruises.

LIST OF OCEANOGRAPHIC STATIONS

Serial No.	Stat.Des.	Latitude (N)	Longitude (E)
1-	I1	28 57.5	48 32.3
2-	I2	29 02.0	48 43.0
3-	I3	29 06.0	48 48.0
4-	I4	29 01.3	48 59.3
5-	I5	29 14.5	49 10.0
6-	I6	29 28.5	49 40.6
7-	I7	29 37.0	49 59.0
8-	I8	29 43.5	50 12.8
9-	II1	28 33.5	48 45.0
10-	II2	28 40.5	49 00.0
11-	II3	28 45.0	49 09.0
12-	II4	28 49.0	49 19.8
13-	II5	28 58.5	49 37.5
14-	II6	29 06.5	49 53.0
15-	III1	28 08.3	49 11.5
16-	III2	28 13.5	49 21.5
17-	III3	28 23.8	49 42.0
18-	III4	28 34.5	50 00.0
19-	III5	28 46.0	50 21.0
20-	III6	28 57.0	50 07.0
21-	IV1	27 39.0	49 30.5
22-	IV2	27 44.3	49 40.0
23-	IV3	27 49.3	49 49.0
24-	IV4	27 55.0	49 59.0
25-	IV5	28 04.0	50 14.0
26-	IV6	28 13.0	50 30.0
27-	IV7	28 22.0	50 46.0
28-	IV8	28 28.0	50 58.0
29-	V1	27 07.0	49 52.0
30-	V2	27 11.3	49 53.8
31-	V3	27 17.3	50 04.0
32-	V4	27 23.0	50 13.5
33-	V5	27 29.0	50 23.5
34-	V6	27 40.0	50 39.0
35-	V7	27 50.0	50 55.0
36-	V8	28 10.0	51 14.0

LIST OF OCEANOGRAPHIC STATIONS (CONT.)

37-	VI1	27 12.0	50 51.0
38-	VI2	27 17.0	50 55.0
39-	VI3	27 30.0	51 10.0
40-	VI4	27 42.0	51 25.0
41-	VII1	26 24.5	50 49.5
42-	VII2	26 31.8	50 58.0
43-	VII3	26 39.5	51 05.8
44-	VII4	26 51.0	51 14.0
45-	VII5	27 00.0	51 26.0
46-	VII6	27 16.0	51 42.0
47-	VII7	27 29.0	51 56.0
48-	VII1′	26 04.0	51 30.0
49-	VII2′	26 10.0	51 40.0
50-	VII3′	26 23.0	51 52.0
51-	VII4′	26 35.0	52 08.0
52-	VII5′	26 53.0	52 20.0
53-	VII6′	27 07.0	52 34.0
54-	VIII1	26 15.0	51 10.0
55-	VIII2	26 23.0	51 10.0
56-	VIII3	26 37.0	51 10.0
57-	VIII4	26 51.0	51 10.0
58-	IX1	24 28.0	52 31
59-	IX2	24 38.0	52 43.8
60-	IX3	24 52.3	52 48.8
61-	IX4	25 04.3	52 53.0
62-	IX5	25 14.5	52 56.0
63-	IX6	25 23.0	52 58.5
64-	IX7	25 30.5	53 01.3
65-	IX8	25 41.0	53 04.3
66-	IX9	25 53.0	53 07.0
67-	IX10	26 13.0	53 13.0
68-	IX11	26 40.0	53 21.0
69-	IX12	26 52.0	53 25.0
70-	X1	24 58.5	53 46.0
71-	X2	25 08.5	53 47.3
72-	X3	25 19.3	53 48.3
73-	X4	25 30.0	53 50.0
74-	X5	25 56.0	53 52.0

LIST OF OCEANOGRAPHIC STATIONS (CONT.)

75-	X6	26 20.0	53 56.0
76-	XI1	25 00.0	54 35.5
77-	XI2	25 09.2	54 34.3
78-	XI3	25 18.2	54 33.0
79-	XI4	25 28.0	54 32.0
80-	XI5	25 50.0	54 30.0
81-	XI6	26 10.0	54 27.0
82-	XII1	25 33.5	55 19.3
83-	XII2	25 43.0	55 15.0
84-	XII3	26 00.0	55 07.0
85-	XII4	26 10.0	55 03.0
86-	XII5	26 22.0	54 59.0
87-	XIII1	25 51.0	55 56.8
88-	XIII2	25 59.8	55 51.3
89-	XIII3	26 13.0	55 46.0
90-	XIII4	26 25.0	55 40.0
91-	XIV1	26 22.5	56 13.0
92-	XIV2	26 27.0	56 11.5
93-	XIV3	26 40.0	56 11.0
94-	XIV4	26 50.0	56 10.0
95-	XV1	26 08.0	56 33.0
96-	XV2	26 10.0	56 40.0
97-	XV3	26 23.0	56 58.5

C.II : GEOLOGICAL OCEANOGRAPHY

1. **COASTAL AREAS**

1.1 Survey of the intertidal and nearshore subtidal areas including salt marshes, mangrove, to assess the fate of oil pollution.

1.2 Collection of samples for the purpose of chemical analysis to quantify oil-pollutants.

1.3 Establishment of a sediment distribution map describing sediment types, texture and biogenic and non-biogenic constituents to enhance the ecological assessment.

1.4 Assessment of suspended sediment (pluvial and dust-fall out) and its associated pollutants particularly in the northern ROPME Sea Area.

2. **METHODS**

To achieve the above-mentioned objectives several methods are suggested:

2.1 Aerial photography and remote sensing.

2.2 Surface and sub-surface sediment sampling.

2.3 Reliable navigation system.

For sampling treatment and analysis it is recommended that all concerned institutions and/or agencies take into account MOOPAM.

3. **OFFSHORE AREAS**

3.1 Survey the sediments of the offshore areas to assess the fate of oil.

3.2 Collection of bottom samples for chemical analysis.

3.3 Constitution of a reconnaissance sediment distribution map, particularly for its western and northern part.

3.4 Update the bathymetric charts, with special reference to the northern area.

4. **LONG-TERM PROGRAMME FOR ROPME SEA AREA**

4.1 Developing a geo-dynamical regional model.

4.2 Conducting bio-geochemical studies of sediment-water interface.

4.3 Study the impact of the miscellaneous activities (dredging, etc.) on the non-living marine resources.

APPENDIX D

SUB-GROUP D: POLICY AND INTERNATIONAL CO-OPERATION

1. OCEANOGRAPHIC CO-OPERATION AND TIME SCALE

The need for oceanographic cooperation in the ROPME region can be divided into three time frames:

- Emergency
- Short term (for purposes of this work plan, "short-term" is 12 months)
- Long term (for purposes of this work plan, "long-term" is 5 years)

International cooperation for emergency activities is being carried out by IMO and bilateral arrangements.

The IOC should take a leadership role for the short-term and long-term phases of this effort in accordance with the UN Interagency Plan of Action being coordinated by UNEP. The IOC Secretariat should informally coordinate proposed actions with the WMO and WHO, in addition to the formal coordination of related components which is to take place through the UN Interagency Plan of Action.

Information management is one thread that critically links these phases.

Activities should focus on two goals: (i) the effects of the oil spill and burning oil wells on the ecology of the area, and (ii) knowledge that can be gained that will be helpful in addressing future oil spills.

2. POLICY CONSIDERATIONS AND RECOMMENDATIONS

Regional support is critical; international support should be an adjunct to regional cooperation. In the short-term IOC can take a stronger role, analogous to the IMO role in the emergency response portion, to facilitate the long-term goal of a revitalized regional infrastructure and network. Ideally, the region would be able to store, maintain, and share equipment, conduct training programs, etc., through the ROPME Convention and protocols for cooperation, the legal basis established in 1978.

The present environmental response effort, particularly in Saudi Arabia, offers an unprecedented opportunity for accelerating long-term goals-e.g., an expanded data base, training of scientists from the region, provision of technology. The region should move quickly to take advantage of this opportunity. Efforts should build on those pregrams already underway, such as those in Saudi Arabia.

Lessons can be learned for future situations in this region that is particularly vulnerable to oil spills. Cumulative effects of oil spills in the Gulf are also not known. There is, in fact, much still to be learned on this subject for all IOC Member states.

Information flow is a problem. There is misinformation concerning the status of adverse effects in the Gulf. Attention needs to be given to communications.

Efforts should now focus on waters most heavily impacted, but all Gulf States should have baseline surveys.

IOC can facilitate the establishment of data centers. The regional data base being developed by the UN Interagency Plan of Action can be the starting point, provided that these data can be made freely available. The concept of a centralized data center is, however, no longer required due to advancements in technology and communications whereby each country can conceivably manage its own center, using a common data base. The key issue is availability of high quality data. Data obtained from monitoring programmes must be freely exchanged. In this context, it would be a good start if at one focal point, information would be collected and made freely available concerning past, current and planned marine-related activities in the ROPME region.

IOC advice is needed on the regional oceanographic infrastructure requirements for Kuwait; a mission to Kuwait and other countries is suggested for this purpose.

Training- IOC can facilitate training opportunities, within the framework of its TEMA component, for regional scientists, including on-the-job training in the region. This is probably the best training for long-term needs in the region. Objectives and particular purposes of training should be specified.

ANNEX IX

LIST OF DOCUMENTS*

Document Code	Title
WORKING DOCUMENTS	
IOC/WGOCR-I/1 prov.	Provisional Agenda
IOC/WGOCR-I/1 Add. prov.	Provisional Timetable
IOC/WGOCR-I/2	Annotated Provisional Agenda
IOC/WGOCR-I/3	Summary Report (this Document)
IOC/WGOCR-I/4 prov.	Provisional List of Documents
IOC/WGOCR-I/5 prov.	Provisional List of Participants (available at the Session)
IOC/WGOCR-I/6	Guidelines for the Meeting
INFORMATION DOCUMENTS	
IOC/WGOCR-I/Inf.1	Status Report of IOC Activities in the ROPME Region
IOC/WGOCR-I/Inf.2	Report of IOC Mission to the ROPME Area, April/May 1991
IOC/WGOCR-I/Inf.3	Report of MEPA on Environmental and health Impact of Oil Burning in the Kuwait Oil Fields
IOC/WGOCR-I/Inf.4	Report by Inter Agency Mission to Saudi Arabia and Bahrain, May 1991, NOAA, Washington, D.C.
IOC/WGOCR-I/Inf.5	Preliminary Proposal for an Action Plan to Assess the Environmental Impact of the Oil Spills and Oil Well Fires on the ROPME Sea Area
IOC/WGOCR-I/Inf.6	Programme for the Environmental Assessment of the Impacts of the Gulf War on Coastal and Marine Resources, submitted by IUCN/WWF

* This list is for reference only. No stocks of these documents are maintained, except for the Summary Report.

IOC/WGOCR-I/Inf.7	UNEP/Interagency Consultation on the Environmental Consequences of the Iraq/Kuwait Conflict, Geneva, 5-6 February 1991: Statement on the Results of the Consultation
IOC/WGOCR-I/Inf.8	Second UNEP Inter-agency Consultation: UN Inter-agency Action Plan in ROPME Region, Geneva, 15 March 1991: UN Inter-agency Action Plan in ROPME Region
IOC/WGOCR-I/Inf.9	Introductory Report of the Executive Director: Environmental Consequences of the Armed Conflict between Iraq and Kuwait (UNEP GC/16/4/Add.1)
IOC/WGOCR-I/Inf.10	Brief Status Report on the Implementation of the Plan of Action, submitted by UNEP
IOC/WGOCR-I/Inf.11	Briefing Paper on IMO Activities
IOC/WGOCR-I/Inf.12	Executive Summary of a Report of the WMO Meeting of Experts on the Atmospheric Part of the Joint U.N. Response to the Kuwait Oil Field Fires, Geneva, 27-30 April 1991
IOC/WGOCR-I/Inf.13	Preliminary and Long-Term Programme in ROPME Sea Area: Geology and Physics
IOC/WGOCR-I/Inf.14	Shore Line Assessment and Clean-up, 2 June 1991, Report by MEPA, Saudi Arabia
IOC/WGOCR-I/Inf.15	Report on the Seventh Session of IOC Committee for the GLobal Investigation of Pollution in the Marine Environment, Paris, 21-25 January 1991