Intergovernmental Oceanographic Commission

Workshop Report No. 38

IOC/ROPME/UNEP Symposium on Fate and Fluxes of Oil Pollutants in the Kuwait Action Plan Region

Basrah, Iraq, 8-12 January 1984




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IOC Workshop Reports

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No.	Title	Publishing Body	Languages
1	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia (Report of the IDOE Workshop on); Bangkok, Thailand 24-29 September 1973 UNDP (CCOP), 138 pp.	Office of the Project Manager UNDP/CCOP c/o ESCAP Sala Santitham Bangkok 2, Thailand	English
2	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974 (Unesco Technical Paper in Marine Sciences, No. 20).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish (out of stock)
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish (out of stock)
4	Report of the Workshop on the Phenomenon known as "El Niño", Guayaquil, Ecuador, 4-12 December 1974.	FAO Via delle Terme di Caracalla 00100 Rome, Italy	English (out of stock) Spanish (out of stock)
5	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock) Spanish
6	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
7	Report of the Scientific Workshop to Initiate Planning for a Co-operative Investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/Unesco/EAC, Nairobi, Kenya, 25 March-2 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
8	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish (out of stock) Russian
11	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish (out of stock)
11 Suppl.	Collected contributions of invited lecturers and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
12	Report of the IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects, Fort-de-France, Martinique 28 November-2 December 1977.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
13	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, Port of Spain, Trinidad, 16-18 January 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas, Abidjan, Ivory Coast, 2-9 May 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific, Santiago de Chile, 6-10 November 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out of stock)
16	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Russian
17	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS), Moscow, 9-11 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
17 Suppl.	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, Moscow, 2-6 April 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
18	IOC/Unesco Workshop on Syllabus for Training Marine Technicians, Miami, 22-26 May 1978 (Unesco reports in marine sciences, No. 4)	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
19	IOC Workshop on Marine Science Syllabus for Secondary Schools, Llantwit Major, Wales, U.K., 5-9 June 1978 (Unesco reports in marine sciences, No. 5).	Division of Marine Sciences, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian Arabic
20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources, Bandung, Indonesia, 17-21 October 1978.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
21	Second IDOE Symposium on Turbulence in the Ocean, Liège, Belgium, 7-18 May 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
22	Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish Russian
23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Russian
24	WESTPAC Workshop on Coastal Transport of Pollutants, Tokyo, 27-31 March 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (out o
25	Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters, Bermuda, 11-26 January 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English (superseded by IOC Technical Series No. 22
26	IOC Workshop on Coastal Area Management in the Caribbean Region, Mexico City, 24 September-5 October 1979.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English Spanish
27	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Nouméa, New Caledonia, 9-15 October 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
28	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes Lima, 20 April-5 May 1980.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
29	WESTPAC Workshop on Marine biological methodology Tokyo, 9-14 February 1981.	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
30	International Workshop on Marine Pollution in the South-West Atlantic Montevideo, 10-14 November 1980.	IOC, Unesco Place de Fontenoy, 75700 Paris, France	English (out of Spanish
31	Third International Workshop on Marine Geoscience Heidelberg, 19-24 July 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
32	UNU/IOC/Unesco Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the context of the New Ocean Regime Paris, 27 September - 1 October 1982	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish

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SC-86/WS/6

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1. PREFACE

This Symposium was sponsored by the Regional Organisation for the Protection of the Marine Environment (ROPME) who has its Secretariat in Kuwait, and was organised by the Marine Science Centre of the University of Basrah (Iraq) in co-operation with the Intergovernmental Oceanographic Commission (IOC) and the United Nations Environment Programme (UNEP).

The principal objectives of the Symposium were to:-

1. Review information on fate and fluxes of oil pollutants in the KAP region;

2. Present and discuss available information on oil pollutants in the KAP region.

The Symposium was held from 8 to 12 January 1984 at the Sheraton Hotel in Basrah, and was attended by 100 participants from the Kuwait Action Plan (KAP) Region, Europe, China and Canada (Annex V).

2. OPENING OF THE WORKSHOP

The Workshop was opened by the President of Basrah University, Dr Abdul Elah Al-Khashab who is also Chairman of the Iraqi National Oceanographic Committee. In his opening address he welcomed all the participants to Basrah and emphasised the importance which the University attached to this Symposium.

Dr Najah A. Hussain, Director of the Marine Science Centre, welcomed delegates on behalf of the Centre and outlined its activities. These include plans for studying the effect of petroleum hydrocarbons in the Shatt al Arab waterway during 1984-1986. He hoped that the Regional Organisation for the Protection of the Marine Environment (ROPME) would continue its role in protecting the marine environment and develop expertise amongst personnel within the region to undertake pollution and intercalibration studies.

On behalf of the Regional Organisation for the Protection of the Marine Environment (ROPME), Dr Layth Al-Kassab welcomed delegates to the Symposium and then outlined the role of ROPME. He hoped that the Symposium would add significantly to knowledge of oil pollution and the fate of oil in the Gulf region. He thanked all those who had been involved in the initiation and organisation of the meeting and for their positive co-operation with programmes undertaken by UNESCO, IOC and UNEP. He also expressed his appreciation for the efforts of the Government of Iraq, in particular the Ministry of Health and the secretariat of the Marine Enviromental Council.

Dr Makram A. Gerges of the Intergovernmental Oceanographic Commission (IOC) underlined the importance of oil pollution in the Gulf area and emphasised the importance which IOC and UNESCO attach to marine science. He indicated that IOC would continue to be involved in fruitful co-operation with the marine scientific community of the KAP Region in developing further studies and that IOC would be pleased to consider proposals for future work. In his closing remarks he thanked the Iraqi National

Oceanographic Committee and all those concerned with the organisation of the Symposium. The opening statements are given in Annex II.

3. CONDUCT OF THE WORKSHOP

The Symposium was divided into five separate sessions each of which was introduced by a Keynote lecture followed by a series of shorter scientific presentations. Each session concluded with an open discussion concerning its content. The timetable is given in Annex I.

The sessions were as follows:

(i) Numerical modelling of petroleum introduced into the marine environment.

(ii) Aspects of photo-oxidation of oil.

(iii) Microbial degradation of oil.

(iv) The impact of petroleum on marine organisms.

(v) The state of oil pollution in the KAP region.

At the end of the five formal sessions the Symposium split up into Working Groups each under the chairmanship of a Keynote Speaker. A Working Group on Geology replaced the session on the state of oil pollution in the KAP region. These Working Groups prepared a series of technical recommendations (Annex IV) which were reviewed by all participants in Plenary. On the basis of this the Symposium adopted the following final recommendation.

4. RECOMMENDATION

The Symposium/Workshop

Recognising the importance of studies dealing with the fate and flux of oil pollutants in the KAP region;

Considering the need for additional information on important physical, chemical and biological processes involved in the understanding of the fate, effect and flux of oil;

Considering the importance attached to these processes by marine scientists in the region and the need to carry out further studies;

RECOMMENDS:

(i) The establishment of a regional data centre containing information on all types of oil produced in the KAP region and other relevant data collected.

(ii) The exchange of information between scientists in the region to foster continuous interaction between various research groups.

(iii) That intercalibration of all chemical, biological and physical measurements is carried out according to methods adopted by ROPME which should be continuously updated taking into consideration the experience of other regional international organisations, especially GEMSI where appropriate.

(iv) The training of young scientists in the KAP region in the techniques, data handling and interpretation related to all fields associated with oil pollution.

(v) Convening another Symposium preferably with full participation of ROPME member states to review the status and progress of studies on the fate and flux of oil in the region.

(vi) Organisation of specialised workshops dealing with:-

(a) Bioaccumulation and metabolism of oil derived components and their effect on homeostatic mechanisms, (including population dynamics).

(b) Physical processes including meteorological phenomena affecting the fate and transport of oil pollutants in the KAP region.

(vii) Follow up to the recommendations made by the working groups of the Symposium Sub-sections contained in Annex IV.

(viii) The establishment of regional facilities for the development of bioassay techniques and GC/MS analysis.

TIMETABLE

PROGRAMME

SUNDAY th JANUARY 1984

OPENING SESSION

08.00 - 09.00	Registration
09.00	
OPENING CEREMONY	Verses from the Holy Qu'ran
WELCOMING ADDRESS	The President of Basrah University and Chairman of the Iraqi National Oceanographic Committee, Dr Abdul Elah Al-Khashab
ADDRESSES	The Director of the Marine Science Centre, Dr Najah A. Hussain
	Representative of the Executive Secretary of ROPME, Dr Layth Al Kassab
	Representative of IOC Dr Makram Gerges
	Representative of UNEP, Dr Danny L. Elder

FIRST SESSION

SOURCES, TRANSPORT AND NUMERICAL MODELLING OF PETROLEUM INTRODUCED INTO THE MARINE ENVIRONMENT

Chairman	Dr Mohammed El-Sabh, University of Quebec, Canada.
10.30 - 11.15	Keynote lecture by Chairman "Sources, transport and numerical modelling of petroleum introduced into the marine environment".
11.15 - 11.45	Dr Oeistein Johansen, University of Trondheim, Norway "Drift and Fate of oil in Marine Environment, results from experimental oil spills and numerical simulation"
11.45 - 12.30	Dr Mustafa Fouda, KISR, Kuwait "Physical monitoring of oil spill movements"
12.30 - 02.00	Lunch invitation by the President of the University

02.00 - 02.30	Dr Farid Shunbo, KISR, Kuwait "Chemical monitoring of oil spill in the marine environment"
02.30 - 03.00	Discussion of First Session

MONDAY 9th JANUARY 1984

SECOND SESSION

ASPECTS OF PHOTO-OXIDATION OF OIL

Chairman	Dr Karsten Palmork, Institute of Marine Research, Norway
09.00 - 09.45	Keynote lecture by the Chairman "Aspects of Photo-oxidation of oil"
09.45 - 10.15	Dr James Readman, Mass Spec Analytical Labs, Stroud, U.K. "Physio-chemical speciation of hydrocarbons in natural waters"
10.15 - 10.45	Coffee
10.45 - 11.15	Dr Joan Grimalt, Instituto De Quimica, Bio-Organica, Spain. "Biogeochemical tranformations of fossil and biogenic hydrocarbons in marine coastal environment"
11.15 - 12.30	Discussion of Second Session
12.30 - 02.00	Lunch

THIRD SESSION

MICROBIAL DEGRADATION OF OIL

Chairman	Dr Simon Stanley, SMBA, Oban, Scotland, U.K.
02.00 - 02.45	Keynote lecture by the Chairman "Microbial degradation of oil"
02.45 - 03.15	Mr Wang Wenxing, Nat. Bureau of Oceanography, Beijing, China "Ecological distribution of the petroleum degrading micro organisms in the Bohai Sea"

03.45 - 04.30	Coffee
03.45 - 04.30	Discussion of Third Session

TUESDAY 10th JANUARY 1984

FOURTH SESSION

THE IMPACT OF PETROLEUM ON MARINE ORGANISMS

Chairman	Dr Karl Lehtinen, Swedish Environmental Research Institute, Sweden "Possible effects of oilspill and clean up in the upper Arabian Gulf"
10.15 - 10.45	Coffee
10.45 - 11.15	Dr Joan Grimalt, Instituto De Quimica, Spain "Some considerations about the use of organisms for monitoring oil pollution in coastal areas"
11.15 - 12.30	Visit to the Marine Science Centre, Basrah University
12.30 - 02.00	Lunch invitation by the Director of the Marine Science Centre
02.00 - 02.30	Dr Hayfa Jaweir, College of Education, Basrah University, Iraq "The effect of low petroleum hydrocarbons on the barnacle semi-balanus balanoides"
02.30 - 03.00	Dr Rifaat Hanna, Institute of Oceanography and Fisheries, Egypt "Physical effects of oil dispersants on the different geomorphological Red Sea coastal environments"
03.00 - 03.30	Coffee
03.30 - 04.00	Dr Jabbar Hasan, Marine Science Centre, University of Basrah "Effect of hydrocarbons on crustaceans"
04.00 - 05.00	Discussion of Fourth Session

WEDNESDAY 11th JANUARY 1984

FIFTH SESSION

ON THE STATE OF OIL POLLUTION IN THE KAP REGION

Chairman	Dr Ali DouAbul, Marine Science Centre, University of Basrah, Iraq
09.00 - 09.45	Keynote lecture by the Chairman "The present state of oil pollution in the KAP region"
09.45 - 10.15	Dr Alain Saliot, University of Paris, France "Hydrocarbons in the Gulf of Aden and Oman Sea"
10.15 - 10.45	Coffee
10.45 - 12.30	Visit to the Centre for Arab Gulf Studies, University of Basrah
12.30 - 02.00	Lunch
02.00 - 02.30	Dr Jamal K. Abaychi, Marine Science Centre, University of Basrah, Iraq "Background levels of petroleum hydrocarbons in Shatt al-Arab River and the North west region of the Arabian Gulf"
02.30 - 03.00	Mr Hamid Al-Saad, Marine Science Centre, University of Basrah, Iraq "Seasonal variations of oil residue in waters of Shatt al-Arab River, Iraq"
03.00 - 03.30	Coffee
03.30 - 04.30	Discussion of Fifth Session

THURSDAY 12th JANUARY 1984

MORNING FREE

Visits were arranged to the following:

Basrah University Research Vessel
Computer Centre - Basrah University
Basrah University New Campus
Technical Institute of Basrah
A Tour around Basrah

02.00 - 03.30	Recommendations
03.30 - 04.00	Coffee
04.00 - 04.30	Closing Ceremony

OPENING STATEMENTS

WELCOMING ADDRESS BY PRESIDENT OF BASRAH UNIVERSITY, DR ABDUL ELAH AL-KHASHAB, Chairman of the Iraqi National Oceanographic Committee

I would like to express my appreciation for the decision to convene the present symposium at the University of Basrah and I would like to emphasise the importance which the University attaches to such activities as part of the framework of scientific and academic development within its specialised faculties and research centres. This takes the form of lectures, seminars and conferences, which reflect the University's interests in developing its programme for scientific and educational development with the ultimate objective to strengthen all fields of knowledge.

The Marine Science Centre of the University of Basrah has demonstrated the University's activity in this field by convening this scientific symposium on "Fate and Fluxes of Oil Pollutants in the Kuwait Action Plan Region" in co-operation with the Regional Organisation for the Protection of the Marine Environment in the Gulf, the Inter-governmental Oceanographic Commission and the Secretariat of the Iraqi Protection Council. The present symposium deals with the very important problem of environmental pollution and the fate of the pollutants in the environment of the Gulf and its effect on the living organisms in the Gulf waters. It also aims to consider the methods used for the measurement of these pollutants and to study their distribution in both sediments, water, air and biota. An important part of this is the knowledge of the sources of pollutants and an understanding of their harmful effects using the latest advances in analytical techniques for the benefit of the peoples of the Arab world and the Gulf area in particular. This explains the important role played by the University of Basrah as a Gulf University in all aspects of science, sharing its responsibilities with its sister Universities in the Gulf and with the Regional and International organisations concerned with oceanographic and environmental pollution problems. This co-operation will also give us competence in our University and its position amongst all the scientific bodies and international scientific projects.

It is worth while to mention that the University of Basrah embodies the only specialised research centre in the field of marine science in Iraq and has the honour of the chairmanship of the Iraq National Oceanographic Commission. This is responsible for all scientific activities in the field of marine science and for co-operation with all other organisations concerned with this field in Iraq.

Finally I would like to thank the Government of Iraq, under whose patronage the meeting has been convened and welcome all the participants to Basrah.

ADDRESSES

Dr Najah A. Hussain, Director of the Marine Science Centre, Basrah

I would like to welcome participants to this meeting on behalf of the Marine Science Centre.

The Marine Science Centre has been established in 1975 as a result of

the growing awareness of Iraq National Oceanographic Commission of the surrounding environment. In 1981 the Centre was designated the sole National Centre to deal with oceanography. The Iraqi Government under the leadership of President Saddam Hussein is concerned with marine sciences and the Iraq National Oceanographic Commission has been established in 1978 as a result of this concern. Iraq at the time being is a member of the Executive Committee of the IOC.

There are two other bodies in Iraq which are concerned with Environmental Protection. The first is the General Council for Protection of the Environment. The second is the Iraqi Society for Protection and Improvement of the environment.

The University of Basrah has a cultural relation with KISR in Kuwait and the Department of Oceanography, University of Qatar. MSC is carrying out the eighteen month program for monitoring and measuring different oceanographic parameters in the Arabian Gulf.

The scientific plan of the MSC for the year 84-86 is concerned with the effect and affect of petroleum hydrocarbons in the Shatt al-Arab River (phase 1) and Iraqi marine territorial waters.

We hope that the Symposium will achieve its aims and provide a realistic recommendation for the region.

We hope that ROPME will promote its call for the protection of the coastal environment, and developing the capabilities of the National personnel, through training courses and specialized Symposiums, besides introducing intercalibration exercises.

Dr Layth Al-Kassab, Regional Organisation for the Protection of Marine Environment

On behalf of the Regional Organisation for the Protection of the Marine Environment and its Executive Secretary, I am honoured to welcome you to this scientific meeting. First of all I would like to wish great success to this Symposium, whose inception and organisation has, to a large extent, been due to the efforts and co-operation of the University of Basrah.

The Kuwait Action Plan for the Protection of the Marine Environment has given great emphasis to training courses and scientific symposia in order to provide specialists in the region and to enable people working in marine sciences to continue their efforts and to increase their knowledge. The success of this policy in the various fields of this important science has enabled the infrastructure and capabilities for executing the regional programmes dealing with marine environmental problems.

Referring to the previous Marine Scientific Activities convened in the region under the sponsorship of ROPME, I would like to express the willingness of the organisation to spare no effort to work towards the realisation of all suggestions made by the member states regarding preparation and co-ordinates for the future activities. In addition the organisation's plans include workshop and symposia which will contribute to the upgrading of personnel carrying out the various regional programmes.

The KAP region is an important area for the exploration, production, shipping and refining of crude oil and this gives great emphasis on the need to be aware of the danger of oil pollution continuously. This necessitates the preparation of oil spill contingency plans and underlines the importance of making concerted efforts to combat oil pollution. These reasons emphasise the importance of the present Symposium and we do hope that the studies and research papers presented, as well as the constructive discussions of this Symposium, will add significantly to our knowledge, so that these objectives will be realised for the benefit of all the marine science specialists in the region.

On behalf of ROPME I thank all concerned with the fruitful co-operation which has led to the success of the Kuwait Action Plan and its regional programmes and express my appreciation for all the sincere efforts made by the Basrah University for initiating the idea of this Symposium. I would like to thank them for their positive co-operation with UNEP's programme and UNESCO's and IOC's work. I would also like to thank the Iraqi Government, the Ministry of Health and the Iraqi Secretariat of the Marine Environmental Council for all their efforts.

Dr Makram A. Gerges, IOC Representative

Honourable Comrade Misban Khudr Hadi, Member of the Regional Leadership of the Arab Ba'ath Socialist Party,
Honourable Governor of Al-Basrah,
Honourable President of Basrah University Professor Dr Abdul Elah Al-Khashab,
Dear Guests, Colleagues and Participants,
Ladies and Gentlemen:

It is a great pleasure for me to address you today on behalf of the Chairman and secretary of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, at the opening of this important Symposium which deals with a scientifically interesting but rather challenging problem, that is the problem of pollution by oil in the marine environment of the Gulf.

The Gulf, being one of the major oil producing regions and among the busiest transport routes in the World, is facing from day to day the threat of such pollution. A fact, which first of all requires a lot of coordinated and integrated efforts and fundamentally needs intensive scientific co-operation at the national as well as at the regional level not only for the study of the marine oil pollution and its effects on the Gulf, but also for its prevention and control.

All of you know that such pollution has several damaging effects on the marine organisms and ecosystems, which in their turn represent serious hazards to human health, in addition to the destruction of the natural beauty of the beaches and coastlines. Therefore the protection of the marine environment against pollution, in general, and oil pollution in particular, is imperative indeed. However, we should admit that, to date there is a general lack of information regarding the fluxes, pathways of many pollutants including the oil pollutants to, and in the ocean, as well as concerning their fate and accumulated effects on the marine environment, and the dynamical and physical processes involved. That is why we consider the present Symposium a key event in this regard. It is a big step forward towards the full understanding

of the overall complexity of the problem and its impact on the Gulf environment.

Nowadays, the protection of the marine environment and its resources against pollution became one of the main factors that encouraged the development of the marine science capabilities in many countries. Meanwhile, several U.N. specialized organizations, each within its field of competance, have promoted and co-ordinated regional research programmes and taken some action in this respect. The Kuwait Action Plan under which the present Symposium is convened, is a good example of such regional activities.

In this context, UNESCO since the early seventies, that is more than ten years ago, has been giving particular attention to the development and strengthening of the marine science capabilities in the Gulf Region. It also gave great importance to the environmental studies, and the pollution-related studies in the Gulf. Towards these objectives, UNESCO with its staff and consultants, carried out several missions to the Region, negotiated and signed agreements with Universities, and Marine Science Centres and institutes in the Gulf states, including our host University of Basrah. This has evoked considerable enthusiasm amongst the marine scientists in the region. Today it is with great pleasure and satisfaction that the Intergovernmental Oceanographic Commission of UNESCO co-sponsors this Symposium the framework of the Kuwait Action Plan sponsored by the Regional Organization for the Protection of the Marine Environment of the Gulf (ROPME) in co-operation with the United Nations Environmental Programme (UNEP). Today's Symposium also comes as a result of the fruitful co-operation with UNESCO and its division of Marine Sciences and the Operational Division for the Arab States and the University of Basrah and its Marine Science Centre

The Intergovernmental Oceanographic Commission of UNESCO would like to continue such fruitful co-operation with the Marine scientific community in the Gulf area for developing fûrther activities in this region. The IOC Secretariat would be most pleased to consider any suggestion in this regard.

Ladies and Gentlemen, before closing, I sincerely wish to express on behalf of the IOC and UNESCO our gratitude to the Iraqi National Oceanographic Committee and the concerned authorities,m in particular Honourable President of Basrah University Dr Abdul Elah Al-Khashab for kindly accepting to host this Symposium, and to express on behalf of all the invited speakers and participants and myself our deep appreciation for all the organizational efforts made by the Marine Science Centre, its Director Dr Najah Aboud Hussain and particularly by the local organisor and co-ordinator of the Symposium Dr Ali DouAbul and his colleagues who spared no effort in organizing the meeting.

Finally, I wish you a very successful meeting with many interesting and fruitful scientific discussions. Thank you.

ABSTRACTS

SESSION 1 KEYNOTE LECTURE

SOURCES, TRANSPORT AND NUMERICAL MODELLING OF PETROLEUM INTRODUCED INTO THE MARINE ENVIRONMENT

Mohammed I. El-Sabh

Département d'Océanographie, Université du Québec à Rimouski 300, ave des Ursulines, Rimouski, Québec, Canada G5L 3A1.

Oil spilled on water undergoes physical, chemical and biological alteration. Rapid physical processes including spreading movement with winds and water currents, evaporation of volatile components, emulsification, dispersion as small droplets into the water, spray injection into the air, dissolution and sedimentation. These processes may all, at one stage or another, come into play in determining the behavior of an oil slick. The time and length scales of each slick are good indices as to which processes will be important at a specific time in a spill history.

Surveying the effect of physical oceanographic processes on oil spills in the Gulf, it is concluded that wind effects are the major factor in oil slick motion while evaporation and sandfall are considered to be important as weathering processes. Considering the particular physical conditions of the Gulf area with extreme evaporation rates, hypersaline water masses and strong local weather effects, it is highly recommended that detailed information on the behavior of oil spills in this particular environment should be gathered.

DRIFT AND FATE OF OIL IN MARINE ENVIRONMENT. RESULTS FROM EXPERIMENTAL OIL SPILLS AND NUMERICAL SIMULATIONS.

Oiestein Johansen

Continental Shelf Institute, I.V.L., Trondheim, Norway.

An interdisciplinary experimental oil spill was conducted by the Norwegian Marine Pollution Research and Monitoring Program - FOH at the Halten Bank offshore Norway in Summer 1982. Some observations related to the drift and weathering of oil are presented in this paper. The predicted capability of established oil spill models are evaluated on this basis. Needs and potentials for improvements, particularly related to surface spreading and vertical dispersion, are discussed.

A new model, which at present is in an early stage of development is shown to compare favourably with observations both with respect to surface spreading and distribution of oil in the water masses.

Further development of the model will be directed towards an operative

oil spill model to be used also in relation to oil combat operations involving chemical dispersants.

PHYSICAL MONITORING OF OIL SPILL MOVEMENTS

Mustafa A. Fouda

Kuwait Institute for Scientific Research

Three major methods for monitoring oil spill movements at sea are discussed. Main advantages and disadvantages of each method are outlined, and the importance of inter-relating these methods in a comprehensive monitoring programme is stressed for the purpose of obtaining the most reliable results. Couple of examples regarding the actual use of these three methods during the recent Nawruz Spill are given.

One extra feature which seems rather unique to oil spills in the KAP region is also discussed. That is the impact of dust fallout from the quite common dust storms in the region on the fate of oil spills on sea. The particular effect on sinking of floating tar balls is considered and some quantitative assessment is given, using a recently constructed model for dust transport over the northern part of the KAP region.

CALCULATION OF SIZES AND AREAS OF OIL SLICKS RESULTING FROM THE NAWRUZ OIL SPILL

Layth Al-Kassab, University of Baghdad, Engineering College, Civil Engineering Department (presently on Secondment to ROPME as the Environmental Engineering Expert).

The volumes and areas of oil slicks which occurred in the KAP Regional waters as the result of several well blow-outs in the Nawruz Oil Field have been calculated. The study includes some technical details on the Nawruz incident which had a direct relation to estimation of quantities of oil leaked from Well No. 3 and the Platforms No. 5 and 9.

To estimate the volume of originated oil slicks, two theories have been applied:

1. Theory of steady state condition or half-life time concept. This theory was used in a similar incident, the Ekofisk blowout, in the North Sea.

2. Theory of Degradation due to the effect of natural environmental factors on oil.

Volumes of oil on surface and areas of slicks have been calculated according to each theory. For the first time, the two theories have been combined in determining the condition of oil slicks.

Three steady state oil slicks existed at Nawruz Oil Field at the time these

calculations were made. The total area of these slicks was 1.74 km^2. The total area of scattered oil slicks which existed 50-70 km away from the Nawruz Oil Field was calculated. The total area was approximately 12 km^2.

ESTIMATION OF SEDIMENT DISCHARGE, SEDIMENTATION RATE, AND THE FATE OF HYDROCARBON RESIDUES OF SHATT-AL-ARAB SEDIMENTS

Hassan H. Salman and Hussein H. Karim

Marine Science Centre, University of Basrah, Iraq.

This study is an attempt to determine the sedimentation rate, transport rate of sediments which are very important factors for trapping hydrocarbons and other oreganic matter. Four theoretical methods were used for three selected cross sections at Ma'qal, 8 km upstream Abul Khasib and Fao. It was found that Bagnold method gives results more closely related to the actual measured data. Total transport rates included according to Bagnold are about 35; 59; 30 kg/Sec at the studied sections respectively. It is also concluded that the deposition of sediments at Fao could mainly be attributed to the tide effect. In section 8 km upstream Abul Khasib, erosion is likely to take place. Net sediment discharge entering the Gulf from Shatt-al-Arab is found to be about 0.93 million tons per year. Sedimentary processes (deposition and erosion) may affect the distribution and concentration of petroleum hydrocarbon residues.

SESSION 2 KEYNOTE LECTURE

ASPECTS OF PHOTO-OXIDATION OF OIL

Karsten Palmork

Institute of Marine Research, Bergen, Norway.

Photo-oxidation of oil is described, and difficulties in the analytical methodology including sampling, isolation and separation methods are discussed. It is stressed that sophisticated methods like Field dissorbtion mass spectrometry and other methods using fully computerized gas chromatography mass spectrometry must be applied so that identities of photo-oxidation products can be detected and quantified.

The importance of analysing the photo-oxidation when performing effect studies is essential and it is also stressed that samples, standards and oil to be analysed are kept out of sunlight. The samples should also be processed at the earliest convenient time.

PHYSICO-CHEMICAL SPECIATION OF HYDROCARBONS IN NATURAL WATERS

James W. Readman

Masspec Analytical, Wall Bridge, Stroud, Gloucester

Physico-chemical speciation is presented as a concept to describe the environmental chemistry of hydrocarbons (with particular reference to the Polyclic Aromatic Hydrocarbons (PAH) in natural waters.

Survey data and experimental results are discussed which demonstrate the presence of different physico-chemical species of PAH in the Tamar Estuary, U.K. The degree and hence chemistry of finding of PAH particulates in the Tamar is shown to be uncompatible with current sorption modelling techniques. This finding has extensive repercussions on prediction of the aquatic chemistry of PAH, including availability of the compounds for fates such as photo-oxidation and biological uptake/toxicity.

BIOGEOCHEMICAL TRANSFORMATIONS OF FOSSIL AND BIOGENIC HYDROCARBONS IN MARINE COASTAL ENVIRONMENTS

Joan Grimalt

Institut de Quimica Bio-Organica (CSIC), Jordi Girona Salgado, Barcelona-34, Spain.

Hydrocarbon patterns characteristic of various environmental reservoirs (sediment, aquatic dissolved and particulate material) were presented and examined in terms of the features which allow the identification of their sources. Special attention was devoted to cases of inhomogeneous distribution of these compounds in such reservoirs. Thus, problems like the influence of grain size in the capacity of accumulation of hydrocarbons in sediments were considered both from the qualitative and quantitative point of view.

Physico-chemical and microbial degradative processes occurring in each reservoir were also reported. Among these, special attention was focussed on: (a) the oxidation of olephins in the water column, (b) the formation of characteristic modes of n-alkanes with no carbon number predominance due to microbial transformation of crude oil spillages or biogenic algal inputs and (c) the extensive biodegradation of straight chain and isoprenoid paraffins in high petroleum polluted sediments. Structural changes concerning the formation of aromatic compounds from natural products were also presented.

Finally, some considerations were made with respect to the application of the instrumentation currently used for the analysis of hydrocarbons in the environment; those involved structural assignation by glass capillary gas chromatography and source elucidation by UV fluorescence.

SESSION 3 KEYNOTE LECTURE

MICROBIAL DEGRADATION OF OIL

Simon O. Stanley

Dunstaffnage Marine Research Laboratory, Oban, Scotland

Physical and chemical conditions affecting the growth of bacteria in the marine environment are discussed with particular emphasis on the high temperatures and salinities which exist in certain parts of the KAP region. The types of bacteria which are capable of degrading the various different fractions of oil are considered and some simple laboratory experiments on oil degradation outlined. The importance of nutrients, particularly nitrate and phosphate, for the growth of bacteria on oil are discussed in relation to nutrient levels in the sea.

Finally oil is considered in terms of an energy source for oil degrading bacteria. The effects that active microbial degradation of oil can have on both nutrient and oxygen levels in the sea and in the sediments are considered particularly in the sediment environment because the activities of oil degrading bacteria can lead to the development of deoxygenated conditions under which conditions of oil degradation will be inhibited.

ECOLOGICAL DISTRIBUTION OF THE PETROLEUM-DEGRADING MICROORGANISMS IN THE BOHAI SEA

Wang Wenxing
Sun Xiuqin
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From analysis of surface seawater and sediments collected at 40 stations in the Bohai Sea from May 1980 to May 1981, it was found that the petroleum-degrading microorganisms mainly consisted of bacteria, filamentous fungi and yeasts. Silica gel-oil plates were used in the enumeration of petroleum-degrading microorganisms by counting the colonis on the microporous filters placed onto the surface of the media. The media contained 1% (Vol/Vol) oil with fungizone added to isolate bacteria, and with streptomycin, tetracycline and chloromycetin added to isolate fungi and yeasts. The number of petroleum-degrading bacteria in the sea water fluctuated from 10^2 cells/L to 10^6 cells/L and the average number of the bacteria in 124 water samples was 10^3 cells/L. The average number of fungi in 86 water samples and that of yeats in 93 water samples were both 10^2 cells/L. The average percentage of the petroleum-degrading bacteria amounted to from 2.3% to 9.5% of marine heterotrophs. The abundance of petroleum-degrading microorganisms in the Bohai Sea water was relatively low as compared with that in severely oil-polluted sea areas. It has been shown that all of the 31 genera (14 of bacteria, 9 of filamentous fungi and 8 of yeasts) were able to degrade petroleum in the Bohai Sea. The oil

concentrations, temperatures, nutrients and dissolved oxygen were determined together with the counting of petroleum-degrading microorganisms. The number of petroleum-degrading microorganisms and the concentration of oil and nutrients in the off-shore waters all appeared to be slightly higher than those in the central waters.

SESSION 4 KEYNOTE LECTURE

EFFECTS OF OIL SPILLS IN THE KAP REGION

Olof Linden
Talk given by Karl Lehtinen

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This paper gives an overview of biological effects of oil spills with special reference to the Gulf area. It is recognized in the paper that there is a lack of knowledge on possible effects by acute oil spills in the Gulf and that extrapolations from spills in other parts of the world must be made at present. It is however of great importance to perform special investigations in the KAP region in order to achieve relevant information on regional conditions, since in some cases elsewhere, extremely large oil spills have caused only minor impact while in other cases very small quantities have caused severe, long term impact on the Marine ecosystem.

POSSIBLE EFFECTS OF OIL SPILLS AND CLEANUP OPERATIONS IN THE UPPER PART OF THE GULF

Anthony Nelson-Smith

University College of Swansea, Swansea, South Wales, U.K.

Environmental factors of importance were outlined. Although there is a reasonable amount of literature on the marine biota and fisheries, it needs updating and there are many gaps to be filled. The location of most normal spillages (as opposed to those resulting from military action) down the western coast of the Gulf and an overall trend in transport towards the SE-SW quadrant suggests that the head of the Gulf should remain relatively free of stranding oil. A scheme currently used around some European shores and utilising lay observers and voluntary bodies as well as official sources in reporting the incidence of pollution, its effects and the extent of cleanup operations was reported; it could be of use in the KAP Region if sufficient contributors could be enrolled. Type of coastal oil pollution was related to impact on the biota, particularly of soft-sediment shores. Preferred cleanup methods were mentioned, with comments on the misuse of dispersants and the desirabilityy of testing products specifically for their suitability under conditions prevailing in the Region. It is important to consider the full ecological implications, not to rely wholly on short-term tank tests. Although disastrous spillages are

deplorable, they also represent large-scale ecological experiments: field-workers should be mobilised not only to help with countermeasures, but also to gather as much information as possible.

SOME CONSIDERATIONS ABOUT THE USE OF ORGANISMS FOR MONITORING OIL POLLUTION IN COASTAL AREAS

Joan Grimalt

Instituto de Quimica Bio-Organca, Barcelona, Spain.

The mussel watch concept for the monitoring of hydrocarbons in the marine coastal area was presented. Some aspects concerning bio-availability and metabolism of these compounds were also considered as well as other general characteristics dealing with mussels biology.

Some examples of application of these organisms in environmental problems were illustrated. Among these the monitoring of low level crude oil hydrocarbon pollution in coastal areas of the western Mediterranean sea and of high chronic inputs in special sites like platform legs was included. Moreover, some applications concerning oil spill identification by means of detailed study of hopane and sterane distributions were shown. The limitations of the use of such organisms were also considered. Among them those related with occurrence, selective accumulation, metabolism and making effects from their own biogenic lipids were detailed.

Concentrations of organisms by pumping large amounts of water through polyurethane foam was presented as an alternative methodology to overcome such problems.

The characteristics of the sampling system (pumps, filters, columns, plugs) were explained and some qualitative and quantitative results were displayed. A final comparison between both man-made and biogenic water concentrating systems with special detail in their space-time variations was performed.

THE EFFECT OF LOW PETROLEUM HYDROCARBONS ON THE BARNACLE *SEMIBALANUS BALANOIDES*

Hayfa Jaweir

College of Education, Basrah University, Iraq.

The toxic effects of three individual petroleum hydrocarbons - benzene (aromatic), cyclohexane (alicyclic) and hexane (aliphatic) on different stages of the barnacle *Semibalanus balanoides* were investigated. They were found to have a significant effect on the survival of both nauplius and cyprid larvae. Nauplius larvae was more sensitive than the cyprid one. Cirral activity of the adult were used as an index to determine the sublethal effects of these chemicals on respiration and feeding behaviour. There was a depressing effect

which was proportionally related to the concentrations applied. Hexane was less toxic among the three hydrocarbons, while there was no significant difference between the toxicity of benzene and that of the cyclohexane.

PHYSICAL EFFECTS OF OIL AND DISPERSANTS ON THE DIFFERENT GEOMORPHOLOGICAL RED SEA COASTAL ENVIRONMENTS

Rifaat G.M. Hanna

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An urgent National marine oil pollution contingency plan was indicated after the "Nabila" oil-spill, to determine the geomorphological features and coastal processes, physical, chemical and biological baseline data of the Egyptian Red Sea Coastal environments.

Application of the "Vulnerability Index" on the Egyptian Red Sea Coastal area was done. The sediments were collected from 115 stations from the Suez to the Bernes and were analysed for the grain size. In addition the physical effects of fresh and weathered crude oil and/with dispersant, on water filtration by different beaches, were studied.

EFFECT OF HYDROCARBONS ON CRUSTACEAN ANIMALS

Jabbar K. Abdul-Hassan

Marine Science Centre, University of Basrah, Iraq.

The responses of several marine crustaceans to some hydrocarbons have been investigated. *Carcinus maenas* (L) were collected from Salthouse Point in the Burry Inlet, *Crangon vulgaris* (L) and *Palaemon serratus* (Pennant) were collected from Swansea Bay, England during the summer of 1981.

The effects of 96 hours exposure to benzene, hexane and crude oil were examined for these species, five concentrations were used from each oil. Benzene was more toxic than the other two compounds, female crabs had more resistance than males and they were more sensitive than *C. vulgaris*.

APPLICATION TO AN OILSPILL VULNERABILITY INDEX TO THE SHORELINE OF KUWAIT, KUWAIT.

Mohammad Al-Saraawi

Kuwait University, Geology Department, Kuwait.

Environmental sensitivity Index which ranks coastal environment on a scale between (1-10) has been established for the shoreline of Kuwait. The

first application of the concept of the system was by (Hayes *et al.*, 1976) i.e., (1) for the least sensitive to damage while (10) is for the most sensitive. The index is a series of maps which show all the coastline configuration with respect to the geology, coastal morphology, biology and the chemistry of the coastline. Based on the physical and process measurement including sedimentary characteristics, coastal processes and meteorological conditions as well as oil distribution, quantity and depth of oil burial and penetration, the environment of deposition within the coastline of Kuwait has been classified as follows:

(1) Head lands with scattered boulders,

(2) Low lying bedrock,

(3) Fine-sand beach,

(4) Coarse-sand beach,

(5) Hard sand flat with few associated organisms,

(6) Cobble beach,

(7) Exposed bedrock low-tide terraces highly bioturbated,

(8) Hard sand flat with substantial bioturbation,

(9) Hard mud flat with substantial bioturbation,

(10) Extremely soft mud with biomass and finally salicornea marsh on the mud.

The system will be a very good tool in the design of the clean up processes along any coastline, since it will provide the highest and the lowest geologic and ecologic sensitivity of the shoreline.

SESSION 5 KEYNOTE LECTURE

THE PRESENT STATE OF OIL POLLUTION IN THE KAP REGION WITH RECOMMENDATIONS FOR FURTHER INVESTIGATIONS

Ali Douabul

Marine Science Centre, University of Basrah, Iraq.

The Gulf is presently experiencing an unprecedental growth and diversification in petroleum and oil allied industries. It is evident then that the Gulf waters are probably being polluted by petroleum hydrocarbons. However, environmental pollution studies in the Gulf are limited by the paucity of previous environmental or ecological research data. Specific marine pollution surveys of the Gulf published up to the time of writing this article are sparse and clearly give only a very patchy view of the full situation. Consequently it is recommended that the following research activity should be undertaken:-

1. Estimation of composition of dissolved hydrocarbons.

2. Environmental fate of petroleum hydrocarbons (especially photo-oxidation, volutilization, and bacterial degradation).

3. U.V. fluorescence technique should be used to assess hydrocarbon concentrations in the region.

4. A mass balance approach to the assessment of environmental contamination in the Gulf.

5. Studies to assess the ecosystem impact of observed contamination should be conducted.

HYDROCARBONS IN THE GULF OF ADEN AND OMAN SEA IN NOVEMBER 1978: THEIR OCCURRENCE AND THEIR FATE IN THE SEDIMENT AND IN THE WATER COLUMN AS DISSOLVED AND ASSOCIATED WITH SMALL AND LARGE SIZE PARTICLES.

Alain Saliot

Laboratoire de physique et chimie marines de l'Université Pierre et Marie Curie, Laboratoire associé au CNRS No. 353, Tour 24-25, 4 Place Jussieu, 75230 Paris Cedex 05, France.

Transfer and transformation processes of hydrocarbons between the superficial ocean and the sediment have been studied in the Gulf of Aden and the Oman Sea, by examining concentrations and distributions of n-alkanes, isoprenoid and aromatic compounds in surface and deep waters in three fractions:- dissolved matter, small size particles and large size (> 50 µm) particles.

A large volume bottle has been used to collect small size particles (> 1 µm) and the water was extracted to obtain the dissolved hydrocarbons. Vertical net tows have provided large size particles (> 50 µm). Saturated acyclic and aromatic hydrocarbons have been identified and quantified by GC and computerized GC/MS.

Top layer waters (50 m) appear slightly polluted; the concentrations in dissolved and particulate hydrocarbons vary from 0.1 to 0.5 $\mu g l^{-1}$. The concentrations of near bottom waters are lower, in the range 0.01 - 0.3 $\mu g l^{-1}$, except for a station located off Muscate characterized by both a relatively high concentration in dissolved (0.55 $\mu g l^{-1}$) and particulate (0.27 $\mu g l^{-1}$) hydrocarbons and a high enrichment of the interstitial water in hydrocarbons with respect to near bottom sea water. The hydrocarbon concentrations of surficial sediments are also low, ranging from 1.4 to 35.3 $\mu g.g^{-1}$ (dry weight sediment).

The precise analysis of n-alkanes and isoprenoid compounds yields further information on the nature of the large size particles. Over a regular distribution between n-C 21 and n-C35 common to the three fractions, pristane is largely predominant with n-C15 and n-C17. Deep large size particles which account for only a small percentage of total hydrocarbons have a composition close to that of the surficial plankton.

Interactions exist between the three hydrocarbon pools, as shown by the transport of large size particles of specific hydrocarbons, originating from surficial bioaccumulation of dissolved compounds such as retene, a polycyclic aromatic hydrocarbon compound of terrigenous origin which was found in both the dissolved matter and the large size particles. The bioaccumulation process was also encountered for polycyclic aromatic hydrocarbons from anthropogenic origin.

This coupling in the order of days or weeks, depending on the settling velocity of large size particles is discussed in terms of hydrocarbon transport. It can explain that in superficial zones where an intense biological activity exists, an important stock of pyrolytic-like or naturally occurring hydrocarbons could be concentrated from seawater through bioaccumulation.

These compounds can settle rapidly as observed in large size particles and be incorporated into sediments even for areas far from anthropogenic or continental sources.

BACKGROUND LEVELS OF PETROLEUM HYDROCARBONS IN SHATT AL-ARAB RIVER AND THE NORTHWESTERN REGION OF THE GULF

Jamal K. Abaychi

Marine Science Centre, University of Basrah, Basrah, Iraq.

A study for the determination of the background levels of hydrocarbons in the waters and sediments in the Shatt al-Arab River and the northwestern region of the Gulf was undertaken. The analysis was carried out by employing a spectrofluorometer instrument. All stations studied show some degree of pollution by hydrocarbons except for a reference station in the marshes area. The concentrations depended on the distance from the source of pollution. However, all concentrations found were withn the range obtained for similar areas in the world.

SEASONAL VARIATIONS OF OIL RESIDUES IN WATERS OF SHATT AL-ARAB RIVER, IRAQ

Hamid T. Al-Saad

Marine Science Centre, University of Basrah, Iraq.

The distribution and seasonal variations of petroleum residues in Shatt al-Arab water column have been determined spectrofluorometrically. Their concentrations were found to vary between 1.7 to 35.4 μgl^{-1} Kuwait crude oil equivalents. The results suggested that petroleum hydrocarbons present in this river originated from diverse sources. Hydrocarbon amounts tend to be highest in winter (averaged 17.4 μgl^{-1}) and lowest in summer (averaged 3.1 μgl^{-1}).

CHEMICAL MONITORING OF OIL SPILL IN THE MARINE ENVIRONMENT

Mahmood Yoosef Abul Raheem

Environment Protection Department, Ministry of Health, Kuwait.

The study is a summary of the activities carried out by a team of workers at the Environment Protection Department during the Nawruz oil spill.

The two main activities were carried out involving quantitative analysis of petroleum hydrocarbons and qualitative analysis aimed at fingerprinting of tar balls that reached the Kuwaiti waters.

The first activity involved the following types of samples:-

1. Determination of the levels of total hydrocarbons in the surface microlayer of reference stations in the offshore area.

2. Determination of the total oil aromatic hydrocarbons content in the water column by gravimetric and spectrofluorometric techniques respectively.

3. Determination of the total aromatic hydrocarbons content of the gut and gills of fishes of commercial value.

The fingerprinting techniques involved mainly:-

1. U/Ni ratio of the tar balls collected in the Kuwaiti and the marine areas of the KAP region and of experimentally weathered Nawruz oil samples.

2. Fingerprinting by contouring of equal fluorescence of samples scanned at 10 nm intervals using excitation wave lengths in the range of 360-450 nm and emission wave lengths in the range of 500-300 nm.

Results and recommendations drawn from the experience gained during that period are also summarized.

REPORTS AND RECOMMENDATIONS OF WORKING GROUPS

1. Physical Oceanography

Chairman: Dr Mohammed El-Sabh

Dr Mustafa Fouda, Dr Basim M. Al-Rumdhan and
Dr Øeistein Johansen

The modelling of the dispersion and movement of oil slicks can provide means for providing information for the environmental management and treatment of spill events. Such models require oceanographic data which is not readily available for the Gulf region, particularly in the summer months. It is also important that a better understanding of the dynamics of the physical, chemical and biological processes is obtained. It is therefore recommended that the following research is undertaken:

1. Collection and analysis of long-term current, tidal and wind data from key sites.

2. Estimation of freshwater inputs and evaporation.

3. The setting up of mixing experiments to determine vertical mixing time.

4. Multidisciplinary studies on experimental oil spillls in order to characterise the behaviour characteristics of oil with particular regard to properties such as weathering, toxicity and dispersibility.

5. Field and laboratory experiments should be undertaken to determine the significance of dustfall on the fate of oil spills particularly in the northern part of the Arabian Gulf.

6. An investigation should be carried out on the use of airborne remote sensing techniques as a means of locating the source area for dustfalls.

7. Hydrographic studies should include the use of drogues to follow the movement of oil spills.

8. Studies should also be aimed at developing a model to predict the risk of oil pollution to risk areas in the KAP region. These studies would take into consideration such facts as shipping lanes, wind and current regimes, as well as the susceptibility of the shoreline to pollution.

2. Chemistry

Chairman: Dr Karsten Palmork

Dr James Readman, Dr Joan Grimalt, Dr Alain Saliot.

The Chemistry Group emphasised the importance of intercalibration studies being undertaken between laboratories in the KAP region and also made the following recommendations:

1. Studies should be undertaken to determine the background levels of total petroleum hydrocarbons using chrysene as a standard and using the methodology described in GEMSI.

2. Specific components should be analysed using GC and GC/MS.

3. Individual components in the surface microlayer need study in order to determine anthropogenic and biogenic inputs.

4. Collections should be made of dry and wet deposits and analysis should be carried out for hydrocarbons and other pollutants which may be transported in the atmosphere (PCB's etc.), especially during duststorms.

5. In each country a library of samples and data storage systems should be established as well as at a regional centre (ROPME).

6. The kinetics of hydrocarbon accumulation in bivalves used for monitoring needs careful study. Other aspects of the selected target organism, such as taxonomy, sexual cycle, lipid biochemistry, must be looked at to determine the effect they will have on the concentrating of hydrocarbons.

3. Microbiology

Chairman: Dr Simon Stanley

Dr Sabah M. Shamshoon, Mr Wang Wenxing

It is most important that any microbiological work is very closely related to chemical, hydrographic, physical and biological studies. Any work on microbiology of oil degradation must closely involve hydrocarbon chemistry. Therefore it is recommended that:

1. A study of microbial oil degradation in the sediment and water column of the KAP area should be carried out. This would involve evaluation of numbers of hydrocarbon oxidising bacteria together with the analysis of hydrocarbons.

2. Studies should be undertaken on the oxidation/reduction status of sediments in the KAP region area to determine to what extent anoxic conditions exist, since this will considerably influence the pathway of oil breakdown.

3. Studies should also be undertaken that take into consideration the particular environmental conditions (high temperature/high salinity) which exist in the Gulf area. The studies must include an investigation of the rates of hydrocarbon breakdown both in situ and laboratory systems.

4. Consideration must also be given to the possible effects of the end products of the microbial degradation of oil.

5. At some stage work should be undertaken on food chains and particularly on the accumulation of potentially toxic components by bacteria as the first step in the food web.

4. Geology

Chairman: Dr Mohammad A. Al-Saraawi

Dr Fikri Khalaf

The Geology Group made the following recommendations:

1. Studies should be undertaken on the ecology of tidal flats and salt marshes in the KAP region.

2. A data centre should be established for all oil produced in the Gulf region.

3. Efforts should be made to further co-operation between scientists in the KAP region.

4. Studies should be undertaken of the coastal morphology of the shoreline with the establishment of environmental sensitivity indices for the region.

5. Studies should be undertaken of the coastal dynamics along the intertidal zone with particular emphasis on areas of mud flats.

6. Studies should also be undertaken of the back shore above high water.

7. More work should be undertaken on the duststorm phenomenon in the Northern part of the KAP region. Emphasis should be given to duststorm dynamics, potential sources, rate of dust fallout, as well as sedimentological and geochemical characteristics. Special consideration should be attributed to the absorbed components of anthropogenic origin.

8. Studies should be undertaken on the sedimentological and geochemical characteristics of suspended sediments in order to understand their sources, transport and their fate in relation to oil pollutants.

9. An assessment should be made of the fate of oil pollutants produced from onshore drilling and processing operations and the impact of these operations on the coastal environment and effect on underground water sources.

10. Studies should be undertaken on surface and shallow subsurface geology of the coastal areas to provide information necessary for the selection of sites for dumping hydrocarbon waste material.

5. Biology

Chairman: Dr K. Lehtinen

Dr A. Nelson-Smith, Dr Hayfa Jaweir

The biological group felt that it was important to take into consideration the following criteria as a basis for their recommendations:

(a) The fate of spilt oil is, in realistic terms, inseparable from its ecological effects;

(b) Any discussion of the clean up measures appropriate to a given spill, or preparation of contingency plans (including vulnerability mapping of coastlines) must also consider biological effects;

(c) Tests and surveys, carried out as recommended below, should be aimed at increasing knowledge both of past, existing or possible future damage to aquatic ecology (i.e. both organisms and their habitats) and the effect of those organisms upon the degradation or immobilisation of the polluting material;

(d) Such knowledge should be available and comprehensible to all those involved in petroleum-related operations (including the siting and erection of physical structures), preferably in the form of an environmental atlas, so that it is of practical rather than purely academic use - we refer to the presentations of Drs Rifaat Hanna and Mohammed Al-Saraawi inter alia.

On the basis of this the following was recommended:

1. Floristic/faunistic baseline studies of shores, nearshore areas and fixed structures;

2. Establishment of reserves and study areas (which should receive a high level of protection) for reference and monitoring purposes;

3. Field monitoring of the "state of health" of representative sites, including the use of indicator species;

4. Field and desk studies of ecological relationships between important species identified by (1) and (3).

5. Laboratory tests including:

   (a) acute bioassays of major polluting products/components and oil-spill chemicals of various sorts, using a broad spectrum of such significant local species for comparative (rather than predictive) purposes;

   (b) long-term (sub-lethal) tests on a smaller spectrum, selected on the basis of the acute tests. Respiration, osmoregulation, behaviour, reproductive success, enzymology and biochemical aspects may be investigated as appropriate. This phase should also include metabolic studies of the transformation, accumulation or degradation of pollutants by these organisms;

   (c) Community testing, using artificial or natural assemblages of organisms in aquaria, ponds or channels, perhaps irrigated with water from specific site(s) under investrigation.

Notes:

1. All types of testing recommended above require frequent field verification and should recognise local environmental conditions (e.g. of temperature and salinity);

2. These suggestions contain a large element of work which is also of academic value and should, in any case, form part of the programme of marine centres in the region. Conversely, we would point out that oil-spills and similar disasters, whilst undesirable, provide opportunities for increasing academic knowledge of ecological and other biological aspects of the region.

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No.	Title	Publishing Body	Languages
32 Suppl.	Papers submitted to the UNU/IOC/Unesco Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime Paris, 27 September-1 October 1982	IOC, Unesco Place de Fontenoy Paris, France	English
33	Workshop on the IREP Component of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR) Halifax, 26-30 September 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
34	IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (Western Africa) Tenerife, 12-17 December 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English French Spanish
35	CCOP/SOPAC-IOC-UNU Workshop on Basic Geo-scientific Marine Research Required for Assessment of Minerals and Hydrocarbons in the South Pacific Suva, Fiji, 3-7 October 1983	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
36	IOC/FAO Workshop on the Improved Uses of Research Vessels Lisbon, 28 May - 2 June 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
36 Suppl.	Papers submitted to the IOC-FAO Workshop on Improved Uses of Research Vessels Lisbon, 28 May-2 June 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
37	IOC/Unesco Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs Colombo, 8-13 July 1985	IOC, Unesco Place de Fontenoy 75700 Paris, France	English
38	IOC/ROPME/UNEP Symposium on Fate and Fluxes of Oil Pollutants in the Kuwait Action Plan Region Basrah, Iraq, 8-12 January 1984	IOC, Unesco Place de Fontenoy 75700 Paris, France	English