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Workshop report No. 10

Report of the Second IOC/WMO Workshop on Marine Pollution (Petroleum) Monitoring

organized with the support of UNEP

Monaco 14-18 June 1976



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

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REPORT OF THE SECOND WORKSHOP ON MARINE POLLUTION

(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

Unesco

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<u>No.</u>	<u>Title</u>	<u>Publishing Body</u>	<u>Languages</u>
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), 158 p.	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 Science, No. 20).	Division of Marine Sciences, Unesco, Place de Fontenoy 75700 Paris, France	English Spanish
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
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 Spanish
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 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(IOC)/UNESCO/EAC, Nairobi, Kenya, 25 March - 2 April 1976.	IOC, Unesco Place de Fontenoy 75700 Paris, France	Full text (English only) Extract and Recommendations: French Spanish Russian

<u>No.</u>	<u>Title</u>	<u>Publishing Body</u>	<u>Languages</u>
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
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 *

* the report and recommendations (but not the presented papers) will be issued in French, Spanish and Russian later.

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SUMMARY REPORT OF THE SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

INTRODUCTION

Convening of a Second Workshop on Marine Pollution (Petroleum) Monitoring was recommended by the fourth joint session of the IOC Working Committee for IGOSS and the WMO Executive Committee Panel on Meteorological Aspects of Ocean Affairs - MAOA (Paris, February 1975).

The governing bodies of IOC and WMO subsequently authorized the convening of the first formal meeting of the Joint IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project, to assist in the evaluation of the Pilot Project and the preparation of the Second Workshop. This meeting was held at the Headquarters of the Natural Environment Research Council (NERC), London, May 1976.

An informal meeting of the Subgroup was held in Kiel (September 1975) to review and develop the methods of sampling and analysis for the monitoring of oil at different depths in the sea.

1. Opening of the Session

The Second Workshop on Marine Pollution (Petroleum) Monitoring was opened by Dr. L. Andr  n, Assistant Secretary of IOC, who thanked the Monegasque Government on behalf of the Chairman of IOC for hosting the Workshop. After referring to the resolutions setting out the formal basis for the convening of the Second Workshop in co-operation with WMO and with the support of UNEP, he introduced His Excellency Dr. A. Crovetto, Minister Plenipotentiary of the Principality of Monaco.

Dr. Crovetto welcomed the participants. He reminded the Second Workshop that a number of laboratories in Monaco, including the Oceanographic Institute and the International Hydrographic Organization, as well as the group of the Pilot Project on Marine Pollution Control by France (St. Raphael), Monaco and Italy (Genova) (RAMOGE), would be most interested in the results of the IGOSS Pilot Project. These results might, he thought, also increase the capability to keep track of petroleum pollution in both the Mediterranean and the open seas.

Dr. Manfred Ehrhardt (Institut f  r Meereskunde, Kiel, Federal Republic of Germany) then took the Chair. He reminded the participants that the first workshop of this nature was held in Gaithersburg, Maryland, USA (May 1974), where the participants modified a draft Operational Plan for the IGOSS Pilot Project to monitor petroleum pollution. The Second Workshop was charged with reviewing the programme of that project and to develop further its Operational Plan, taking into account information provided in national reports and in submitted review lectures

as well as the conclusions of an ensuing discussion. The scientists present were asked to provide the necessary detailed advice based on information contained in relevant documents (see Annex IV, list of documents) and on the outcome of discussions of several specialized ad hoc panels formed during the Workshop.

2. Welcome Address

Mr. Robert Junghans, Chairman of the Working Committee for IGOSS addressed the Second Workshop and reviewed the purpose of the Pilot Project which was to test, in co-operation with on-going national and regional programmes, the organizational machinery of IGOSS for monitoring petroleum pollution and exchanging the resulting collated information. He felt that a proper intercalibration would have to be a key element for the continued success of both the Pilot Project and other marine pollution monitoring systems that might be established with UNEP's support. Proper data collation and exchange under the RNODC system are of similar importance.

He also referred to several other initiatives which have been taken and to the co-operation and significant assistance of the United Nations Environment Programme (UNEP). He considered the new programme for measuring pollution on beaches and in coastal and offshore waters of the Mediterranean, co-ordinated by IOC/WMO/UNEP, as highly relevant to the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring, and noted that it adopted the procedures of the IGOSS Operational Plan.

3. Invited Review Lectures

3.1 Input of oil and its subsequent distribution in the marine environment

Dr. E.M. Levy (Bedford Institute of Oceanography, Dartmouth, Canada) reviewed in his lecture the inputs of oil into the marine environment. These amount to approximately 6×10^6 tons/year, of which 2×10^6 tons/year originate from marine transportation. Oil pollution occurs in the atmosphere, on the ocean surface as films and as tar balls, dissolved/dispersed in the water column, deposited in sediments, and as oil stranded on beaches. Surface films are typically $10 - 100 \text{ mg/m}^2$ in the Atlantic and North Sea with values more than a hundred times greater in the Mediterranean. Tar ball concentrations are usually $0-0.1 \text{ mg/m}^2$ in the North Atlantic, $0-5 \text{ mg/m}^2$ in the Caribbean and $10-1000 \text{ mg/m}^2$ in the Western Sargasso Sea and in the Mediterranean. Few data exist for the Pacific Ocean. In both the Atlantic and Pacific Oceans, the distribution of floating tar is predominantly affected by the surface currents and primarily associated with the clockwise gyres. Reports of flakes of tar balls dispersed in the water column suggest that the amount of the flakes may be four times the standing crop of the tar balls themselves. Concentrations of dissolved/dispersed hydrocarbons average between $0-10 \text{ } \mu\text{g/l}$ with a few values of $10-100 \text{ } \mu\text{g/l}$. Higher values for the open ocean can be considered as suspect. Tar ball concentrations are lower in some coastal waters with rapid circulation. Petroleum hydrocarbon concentrations of more than 50 ppm in the sediment are rarely measured outside chronically polluted areas.

It was noted that intercomparison of the above results, especially those concerning dissolved/dispersed oil, are most difficult because of the use of different sampling and analysis procedures. Variations in the petroleum composition may give rise to a difference in the recorded values by one order of magnitude. Still, much specific data are lacking for many ocean areas. It is hoped that the IGOSS Pilot Project by filling these gaps can facilitate intercomparison of data from petroleum monitoring schemes.

3.2 Hydrocarbons in Sea Surface Waters

This presentation was given by Dr. M.P. Nesterova (Institute of Oceanology of the Academy of Sciences (USSR)). Oil pollution in surface waters was detected at many stations during an Atlantic survey and in fifty percent of 760 stations in areas of the Pacific and Indian Oceans. A remote detector of surface oil slicks, employing a fluorescence principle, has been developed which detected slicks hundreds of miles in extent.

The main sources of marine pollution by oil are tank washings, oil spillages and river discharges. Input from tankers are estimated to be about two million tons per year, and if the trend continues this input will become about six million tons per year by 1980.

Some scientists have expressed the view that petroleum pollution of the sea may drastically affect natural processes, as evaporation in areas with slicks can be reduced by half. Similar effects might be expected from stable reverse petroleum-water emulsions, which eventually may be transported by surface currents for thousands of kilometres from the location of oil discharge. Such surface transport of stabilized oil deposits seems to remove them from areas of circulation into central areas with little circulation. Further studies aimed at discerning the kinetics and processes for dispersion and removal seem critical for modelling or for predicting oil pollution from the data of various activities such as the IGOSS Pilot Project.

3.3 Environmentally induced changes on oil pollution

This lecture was given by Dr. B. Morris (Bermuda Biological Station of Research, Bermuda). Dispersion and degradation of petroleum in the environment are two removal mechanisms for pollutants. Such mechanisms can only be fully understood if also the chemical nature of petroleum is taken into account. The five major components of oil are alkanes, cycloalkanes, aromatics, asphaltenes and non-hydrocarbon compounds. Normally, the chief mechanism of petroleum dispersion in the marine environment is evaporation and solubilization. As much as half of a spilled crude oil and all of some refined products could eventually be removed by these processes.

Even after prolonged periods of time, a spilled oil will retain most hydrocarbons which boil above 375°C and have a chain length of C₁₅ or more. Dispersion of slicks into the water may enhance their biological degradation. Petroleum, as slicks, is susceptible to UV-oxidation, forming products such as carboxylic acid which render it more soluble and which will also act as surfactants for the weathered oil. Biological degradation leads chiefly to the formation of isostructural alcohols and sugars which are also more susceptible to solubilization.

Following evaporation and solubilization, microbial degradation is most important for petroleum removal. Microbial degradation mostly affects n-alkanes with molecules up to C₂₀, then aromatics, and last the cycloalkanes. Only up to half of a crude oil volume is affected biologically, and this process rarely involves molecules above C₂₅, or asphaltenes. Both measurements and predictions based on weathering studies indicate that the asphaltene fraction, when amounting up to 25% of the crude, can form the basis of almost completely stable petroleum residues with a lifetime of up to a year in ocean waters.

3.4 Ecological effects of oil

The lecture was presented by Dr. J. Stegeman (Woods Hole Oceanographic Institution, USA). He pointed out that the uptake of petroleum hydrocarbons by marine organisms is very difficult to simulate under laboratory conditions, as variables and unknowns in the experimental design are numerous. In many species petroleum hydrocarbons are taken up chiefly through the gills and become subsequently concentrated in lipid-rich tissues. However, a transfer of the animals into clean water results in a reduction of hydrocarbon body burdens (depuration). Most aliphatic and aromatic hydrocarbons can be accumulated and depurated, though at different rates.

Kinetic studies should resolve problems related to different modes of uptake and discharge for different compounds. For example, bivalves can be used as petroleum pollution monitoring organisms only after detailed kinetic experiments on the uptake and depuration. Also a knowledge of details of the exposure chemistry should facilitate the interpretation of toxicity tests, particularly when comparing laboratory results with field measurements. A number of exposure variables such as time, concentration, composition of the petroleum fraction and life stage of the organism can be extremely important in modifying the response of the organisms to this pollutant. Generally, lower boiling, more soluble, more highly substituted aromatics (such as those predominantly contained in refined fractions) are more toxic. Responses to sublethal concentrations may include genetic changes, immunological, behavioural and latent effects. Examples of sublethal metabolic effects are decreased lipo-genesis and induction of hydrocarbon hydroxylase (mixed function oxidase) activity. Such sublethal responses may serve as potential bio-indicators of petroleum exposures. Further research, however, is needed to establish whether, for example, carcinogenesis and diversification of lower trophic levels are petroleum-specific responses.

3.5 Methodology, instrumentation and standards for petroleum analysis in the marine environment

This lecture was given by Dr. A. Zsolnay (Duke University, Beaufort, N.C., USA). He explained that it is important to make a distinction between aliphatic and aromatic compounds which can be of both petrogenic and recent biogenic origin, and olefins which are mostly of recent biogenic origin. Extraction and analysis procedures should be capable of measuring both types as this would help to distinguish petroleum from natural hydrocarbons. A review and comparison of sample containers, extraction procedures and analytical methods was made.

Important considerations regarding sampling include the use of non-plastic samplers deployed as remotely as possible from ships and hydrowires to avoid contamination. With regard to the concentrations of petroleum constituents from

the sample, liquid/liquid extraction seems to yield the best results in terms of low contamination but only limited volumes can be extracted. As for analytical procedures, the UV-fluorescence technique is sufficiently sensitive, but might need to be made more selective by a simple column chromatographic clean-up procedure to remove natural fluorescent and quenching compounds which may be present in the samples. Also optimum excitation and detection wavelengths need evaluation. Intercomparison materials should be stable, storable, inexpensive and comparable to a hydrocarbon extract from sea water. An acceptable compound could be a hydrocarbon or a mixture of hydrocarbons.

4. Adoption of the Agenda

The agenda was adopted without any further discussion (the agenda is attached as Annex I).

5. Report of the IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project

The Chairman of the Joint IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project, Dr.M. Ehrhardt, reported on the work of the Subgroup which met in London, 3-7 May 1976 (IOC-WMO/MAPMOPP-I/3). The Subgroup felt that the Pilot Project on Marine Pollution (Petroleum) Monitoring was capable of providing large amounts of data which, in the case of visual observations of oil slicks, may be used to identify polluted ocean surface areas. Fewer data were, however, available on dissolved/dispersed, floating, and stranded oil residues. Therefore, a quantitative assessment of these data is much more difficult. A total of 13 countries reported observations of surface oil slicks. The average number of positive observations amounted to 7.5% of the total number of observations based on the data from five countries reporting quantitative results. The group expressed criticism on four points: (1) Future reports should separate hydrocarbon slicks from other forms of pollution, (2) the magnitude of oil slicks should always be recorded. Recording only slicks without a regular reporting of their absence may lead to biased data unless they are processed properly. In this context, the frequency of observations should always be included. (3) For the measurement of dissolved/dispersed hydrocarbons, no uniform standard was used or even available; also the precision and sensitivity of the analytical procedures were rarely noted. (4) Any summary report by a country or eventually by a World Data Centre should include maps with some quantitative indication of the distribution of slicks, taking into account their size and frequency of occurrence. Such maps, of course, are desirable also for other parameters if sufficient data are available.

The Subgroup of Experts made the following major proposals concerning the Marine Pollution (Petroleum) Monitoring Pilot Project:

- (1) Standard/reference solutions or extracts should be prepared and circulated to all participating countries, and a suitable laboratory should be identified and supported for this task. The reference solution could include extracted samples of petroleum hydrocarbons preserved in a suitable solvent as well as a chemical compound or compounds (yet to be identified) with known fluorescence properties.

- (2) Different methods for measuring dissolved/dispersed hydrocarbons should be intercalibrated. Ideally this should be done by hydrocarbon analysis of identical sea-water samples.
- (3) The measurement of micro-particulate oil residues (tar balls) in the water column might be important in understanding the removal of oil from the sea surface. This, however, should be considered as an extension of present activities within the Pilot Project.
- (4) Submission of data to World Data Centres A and B (Washington and Moscow) should take place with a minimum frequency of one set of data every six months. The data centres, in co-operation with national co-ordinators, should ensure the use of standard formats. Maps or computer print-outs showing the spatial distribution of measured pollutants should be prepared and returned to national centres to encourage their co-operation and participation.
- (5) It would be premature to expand the scope of the Pilot Project until after a scientific review. However, it should be recognized that some form of a global petroleum pollution monitoring might be envisioned.

The Subgroup also suggested that the present Operational Plan should not be expanded beyond sampling for dissolved/dispersed hydrocarbons at 1 m depth because of the recognized methodological problems. The merits and shortcomings of the ultra violet (UV) fluorescence method for the measurement of dissolved/dispersed petroleum hydrocarbons were also discussed. The Subgroup felt that fluorescent material of recent biogenic origin may be carried through the work-up procedure recommended in the original Operational Plan, especially in areas of high biological productivity. The possibility also exists that fluorescence quenching material finds its way into the final extract prepared for the actual measurement. It was agreed, therefore, to investigate a simple column chromatographic clean-up procedure. Finally, the different nets used for tar-ball sampling should be intercalibrated.

The Subgroup concluded that in spite of some deficiencies in the Pilot Project, it was a useful exercise, and expressed hope that the mentioned deficiencies would be rectified by the Second Workshop through minor modifications of the Operational Plan.

In the plenary discussion following this presentation, the views were expressed that recorded data for coastal or estuarine petroleum concentrations were rather high and thus should be analyzed separately from open-ocean data. It was further noted that specific proposals were made for technical assistance and for the preparation and provision of intercalibration materials. It was also considered to be desirable that any modification of the Operational Plan or any suggestions for intercalibration activities be taken into account during the implementation of the IOC-WMO/UNEP Joint Co-ordinated Pilot Project on Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters in the Mediterranean, the Operational Plan of which is very similar to that of the IGOS Marine Pollution (Petroleum) Monitoring Pilot Project.

6. Reports of National Co-ordinators

National co-ordinators of countries participating in the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring made short statements and described operational problems that had been encountered. Below follows a summary of information and comments received from different countries:

- BELGIUM participated only with visual observations, but is now willing to expand into the field of other petroleum measurements at both a North Sea and a Mediterranean location.
- CANADA has a long-standing programme of studies of dispersed/dissolved petroleum in the open ocean. There are also daily collections of tar balls and sampling of dispersed/dissolved petroleum at one metre depth at weather station "P" in the Pacific.
- EGYPT has taken preliminary steps to engage the Institute of Oceanography and Fisheries, Alexandria, in the Pilot Project in the Mediterranean area as a part of the IOC-WMO/UNEP programme. The Red Sea branch of the Institute of Oceanography and Fisheries will also be participating in the Network for Monitoring Oil within the framework of the Regional Programme of Environmental Studies of the Red Sea and the Gulf of Aden, sponsored by the Arab League Educational, Cultural and Scientific Organization (ALECSO) and approved at the Jeddah II Conference in January 1976. It was recommended that a Workshop be convened to prepare the detailed operational document for such a programme. Similar monitoring programmes are envisaged in the Arabian Gulf. +) Due to the lack of a sea-going vessel the monitoring activities are restricted to coastal areas and work along the tanker routes is excluded. It was pointed out that it is still very important to collect as much data as possible on petroleum pollution in coastal areas, such as tar balls on beaches, tar balls and oil slicks in near-shore waters, and it was considered that many more countries should engage in such work.
- FRANCE has so far measured dissolved/dispersed petroleum concentrations off three coastal estuaries using a remote sampling buoy in one case. Data on visual observations made by the Service Hydrographique will be circulated shortly.
- GERMANY
(FED.REP.) presented computer plots based on over 10,000 visual observations. This large input results from a combined submission of meteorological data sheets and the project log sheets kept by meteorological port officers, co-ordination which might be worthwhile considering in other countries. However, the scientific value of the data collected was thought to be rather limited because of difficulties in quantification.

+) The term "Arabian Gulf" describes the gulf geographically situated between Iran and the Arabian peninsula. Based on conventional practice, however, many countries use the term Persian Gulf.

It was also noted that visual observations were limited to daylight hours and almost exclusively to shipping lanes. With regard to the measurements of dissolved/dispersed petroleum residues the reported data were considered still to need some evaluation, since the techniques contained in the present Operational Plan have to be intercalibrated. It was felt that so far this Pilot Project provided qualitative rather than quantitative data.

ISRAEL

although not participating until now in the Pilot Project, has contributed data on stranded beach tar. It showed that much higher concentrations were found on the Mediterranean coast of Israel than had been observed in other areas. The tar balls are uniformly distributed on the west-facing part of the coast and are of Middle Eastern rather than North African origin. During the period April 1975 - April 1976, the amounts of stranded tar were found to decrease. It was felt an excellent approach to combine stranded tar measurements with research concerning the origin and fate of tar. Improvements of methods for stranded tar measurements were suggested by the work carried out so far.

JAPAN

contributed much data on tar balls and dissolved hydrocarbons but, so far, few visual observations have been reported. Japan is willing to offer technical assistance related to data archiving in the South-east Asian area.

LIBYA

has been participating in the Pilot Project since 1975 through its Marine Fisheries Research Centre. This activity will be augmented after completion of a new marine research centre in 1977. As in the case of some other developing countries, Libya is requesting training rather than technical assistance.

NETHERLANDS

is contributing data on visual observations, stranded oil and floating tar balls. Measurements of dissolved/dispersed hydrocarbons are not made on a routine basis. Research is under way on comparison of the results of ultra violet (UV) fluorescence measurements with those obtained by other analytical methods.

Further participation in the Pilot Project beyond 1 January 1977 would be considered. This consideration will be based on the recommendation of this Workshop and the possibility of transforming the available and future data into useful products. Modifications of the method for sampling of tar on beaches were proposed.

NIGERIA

has been participating in the Pilot Project since April 1975 and has started observations of stranded oil, but the amount of data is rather small. Present need is not for technical assistance but for training.

SWEDEN

reported mainly on visual observations in geographical areas covered by the Operational Plan. Measurements on dissolved/dispersed hydrocarbons are so far limited in number due to lack of research vessels. Some promising developments in remote sensing techniques and, in co-operation with Soviet scientists, in the use of in situ

devices for the measurement of petroleum hydrocarbons were reported. It was felt that the Pilot Project should not be expanded to include additional parameters before a proper evaluation of its progress has been made. To enable this evaluation, a prolongation of the Pilot Project for another year is considered necessary.

TURKEY

commented on the methods to be used although it is not participating in the Pilot Project. The invited expert felt that gas-liquid chromatography (GLC) is a more reliable and widely applicable method, although UV-fluorescence is probably more efficient for petroleum monitoring purposes.

THAILAND

will participate fully in the Pilot Project from October 1976 and, like some other developing countries, it would appreciate a 1-2 year extension of the Pilot Project to allow a development of its capabilities in this regard. The methodology should be kept simple with minimal alterations of the present Operational Plan.

UNITED KINGDOM

had reservations on the value and interpretation of visual observations. It was also noted that there are striking differences in United Kingdom reports depending on the type of ships used and whether they had been stationary or underway. Further evidence of the limits of the statistical or quantitative value of the visual sightings was demonstrated by the results of one study that showed that 66% of all sighted slicks were subsequently confirmed to be oil. Slick size estimates are also difficult. Concentrations of dissolved petroleum measured by GLC showed large variations in space and time, which further illustrated the difficulty of carrying out meaningful analysis for dissolved/dispersed hydrocarbons.

UNITED STATES

has been participating since the beginning of the Pilot Project in all phases except for surveys of stranded oil. The Coast Guard has been assisted by private vessels from sailing and yachting associations in visual observations. In their function as one of the World Data Centres, the US-RNODC reported having received data from the Federal Republic of Germany and India. The small amount of tar ball data prevented immediate computer collation but more data are anticipated from other unreported US activities. The United States urged an establishment of intercalibration procedures, close association with GIPME and acceleration of training programmes for assisting and encouraging the participation of developing countries. Duke University has offered a training course in petroleum monitoring (and will shortly receive a UNEP contract to begin the course in late 1976).

UNION OF SOVIET

SOCIALIST REPUBLICS

has implemented the Pilot Project and made measurements since 1971. It concludes that the Pilot Project is a useful means of evaluating the mass distribution of oil contamination of the world's oceans. These evaluations should be continued. Intercalibration was highly recommended. Monitoring of pesticides which are products of known human origin and toxicity might be an element to consider in future IGOS projects. The USSR is willing to offer training, beginning in 1977, aboard its oceanographic research vessels. Such a sea-going training programme would include sampling, processing and analysis.

7. Review of the Operational Plan for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring

Before opening the discussion of this item, the chairman invited Dr. T. Church as a member of the GIPME Task Team on Marine Pollution Monitoring to report the views of this group on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project.

Dr. Church stated that the Working Committee for GIPME through the Task Team on Marine Pollution Monitoring discharges as one of its responsibilities the provision of scientific advice relevant to the further development and implementation of marine pollution monitoring programme within IGOSS, by providing a scientific basis upon which such monitoring systems can be further developed, and by providing advice on techniques and methodology (IOC resolutions VIII-20, GIPME-III.2 and IX-9). Accordingly, GIPME also has a mandate to review the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project.

According to the Task Team, the first priority of the Pilot Project should be to test the organizational machinery of IGOSS, acting as an international collator of a set of marine pollution data, with the expectation that a useful outcome of the Pilot Project would allow an estimate of the extent of hydrocarbon contamination of the world oceans. Although this first IGOSS priority has been successful, there seems to be some difficulty in carrying out the observations and measurements with intercalibrated techniques. Therefore, reservations have been expressed as to the scientific value of the observed data. Thus, the GIPME Task Team urges great caution in expanding either the content or time scale of the Pilot Project before a thorough scientific review by the IGOSS Subgroup of Experts and GIPME has been accomplished. However, expansion in terms of participating countries or geographic fields of coverage are to be encouraged only if they do not detract from the important priorities which should be (1) a collection and collation of the data by IGOSS, and (2) some quantification of the extent of petroleum pollution in the open ocean. In both regards, a strictly systematic and statistical basis for the visual observations and intercalibration of the dissolved/dispersed measurements is absolutely essential since any eventual pollution monitoring system has to be based on reliable quantitative data which can be used to describe accurately the status of pollution and to predict trends.

In the opinion of the GIPME Task Team a single high quality laboratory should be designated as soon as possible to prepare an extract which should be circulated for intercalibration. Also intercomparison exercises at sea should be co-ordinated. The Task Team expressed the hope that remote sensing methods would be introduced into the project, which would result in an extended coverage in time and space on a quantitative basis. The co-ordination of relevant on-going remote-sensing activities with the Pilot Project should be encouraged.

Finally, Dr. Church stated that the Working Committee for GIPME anticipates continued participation in all stages of the development of IGOSS marine pollution monitoring systems, including the IOC/WMO/UNEP Baseline Studies on Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters in the Mediterranean.

With a view to reviewing in detail the Operational Plan, the chairman formed three panels charged with specific tasks:

- Panel on Sampling, Sample Preservation, Analytical Procedures and Standards (chairman: A. Zsolnay; rapporteur: E. Levy)
- Panel on Visual Observations, Collection, Processing and Exchange of Data (chairman: Dr. Kohnke; rapporteur: T. Thompson)
- Panel on Training and Technical Assistance (chairman: S. El-Wakeel; rapporteur: B. Morris)

The reports of these panels are contained in Annex III. A summary of the discussion of these reports and their adoption in plenary follows under 8.1.

8. Further development of the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring

8.1 Consideration and adoption of modifications for the Operational Plan for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring

A revised version of the Operational Plan has been published as IOC Manuals and Guides No. 7 "Guide on Operational Procedures for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring". The following is an account of the plenary discussion on the panel reports:

- Sampling, sample preservation, analytical procedures and standards

An urgent need for a detailed technical manual to accompany the Operational Plan was expressed. An offer by Dr. E. Levy to initiate this work by preparing a "recipe" for the analysis of dissolved/dispersed hydrocarbons in sea waters was noted with appreciation. Dr. A. Zsolnay kindly offered to provide detailed descriptions of all other analytical procedures of the Operational Plan including a simple column chromatographic clean-up procedure. The compilation of these descriptions would be undertaken in consultation with the Secretariats of IOC and WMO. He also agreed to provide a note on the proposed use of an intercomparison material (chrysene) and its distribution among laboratories participating in intercalibration exercises. It was noted that chrysene neither provides an absolute standard nor prevents errors of sampling and extraction. It is merely a means of intercomparing analytical methods for UV-fluorescence measurements. However, it is considered a valuable first step towards the intercomparison of dissolved/dispersed hydrocarbon measurements.

- Visual observations, collection, processing and exchange of data

The alterations to the Operational Plan proposed by the panel were endorsed without further discussion.

- Training and technical assistance

It was suggested that the Secretariats should develop the training schedule in such a way as to avoid conflicts with the committed teaching and research schedules of developing countries.

Further, there should be a follow-up phase with training and technical assistance in the developing countries to ensure proper implementation of techniques. A scientist exchange programme could satisfy the needs in this regard.

8.2. Recommendations for further action required for the continued implementation of the Pilot Project on Marine Pollution (Petroleum) Monitoring and its eventual conversion into a regular monitoring programme

The final recommendations adopted by the Second Workshop are listed in Annex II to this Summary Report.

Opening the final plenary session, the Chairman reiterated relevant comments and critiques offered by the Subgroup of Experts and gave some salient points from previous discussions during the workshop:

- The geographic coverage of visual observations needs to be extended, since most data obtained to date are restricted to shipping lanes or to shores in a few localized beach areas.
- Observation of slicks during day time only does not seem to be a problem (the lifetime of surface oil slicks usually exceeds 12 hours; therefore, their observation during daylight hours might well form a basis for their quantification).
- Intercalibration exercises need to be set up for the different neuston samplers used to collect tar balls.
- Analytical procedures involved in the measurement of dissolved/dispersed petroleum also require an intercalibration scheme.
- Research has to be undertaken on the chemical nature of the fluorescing fraction of non-petroleum origin which may be contained in water extracts of dissolved/dispersed hydrocarbons.
- Measurements of dissolved/dispersed hydrocarbons by GLC will give rise to less uniform results than ultra violet (UV) fluorescence measurements, because GLC is also sensitive to aliphatic hydrocarbons. This fraction, due to its relatively easy biological degradability in contrast to the aromatic fraction, leads to a variability in the GLC-results which may be expected to be greater than the variability of the aromatic fraction on which the fluorescence measurements are based.

- Processing of data and their presentation in national reports need improvements with regard to details and uniformity. Every effort should be made by the NODCs to summarize their results in the form of maps. There appears to be a sufficient amount of data for ocean surface oil to do so.

In the following discussion, the Second Workshop re-confirmed the validity of the original objectives and the usefulness of the Pilot Project and the value of the established international co-operation. There was felt to be an urgent need for a thorough scientific evaluation as to whether or not the data gathered within the project do in fact reveal the extent of petroleum pollution in the ocean. The Pilot Project is entering a critical phase as it must be demonstrated whether methodology and organizational machinery of the project are developing in such a way as to provide the basis of a more permanent petroleum pollution monitoring system. One important aspect is that the results of marine pollution monitoring may provide guiding information for discussions such as those taking place in the Third United Nations Conference on the Law of the Sea.

If the Pilot Project is to be a continuing success, broader participation, including countries with limited capabilities, must be encouraged.

The Operational Plan must be kept somewhat flexible to reflect developments in analytical technology, such as improved remote sensing or continuous oil-slick monitoring methods, to add to the present visual observations. This is important, since already much effort is being expended on visual observations from ships of opportunity, and the value of this effort is intended to be raised continually.

Further, the results of the observations should be reported back to the original volunteer observers so as to encourage their continued participation. A continuous data exchange would also increase regional co-operation and lead to a more efficient geographic coverage.

As a solution to the above concerns, it was agreed that the Pilot Project would benefit from being extended by two years, to allow intensified data gathering, collation and final interpretation. However, a scientific report would be prepared by the Subgroup of Experts not later than the end of 1977. Also there should be a review of the international co-operation and technical assistance aspects. These evaluations, together with the advice from the Working Committees for IGOSS and for GIPME would then be the basis for a Third Workshop to advise on the future of the Pilot Project. However, any further extension of pollution monitoring activities is likely to require additional financial support which would need to be sought from UNEP.

Mr. Sella (UNEP) expressed satisfaction at the demonstration that countries are willing to, and do, join in the IGOSS type of multinational project, and at the interest the project had elicited in a number of developing countries. He pointed out that the project was entering a crucial phase in which past errors should be corrected and the validity and value of the results evaluated, since, before supporting the eventual continuation of the project beyond the pilot stage, UNEP would certainly want to be sure that this continuation was fully justified on technical grounds. He added that extension of the Pilot Project over two additional years was likely to involve expenditures greater than those originally anticipated and that whether the corresponding resources could be provided by UNEP would depend on a decision of the Environment Fund.

9. Any other business

No discussion took place under this agenda item.

10. Closure of the Workshop

The session was closed at 1800 Friday 18 June 1976.

ANNEX I

SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

A G E N D A

1. Opening of the Workshop
2. Welcome address
3. Invited review lectures
4. Adoption of the Agenda
5. Report of the IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project
6. Report of National Co-ordinators
7. Review of the Operational Plan for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring
8. Further development of the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring
 - 8.1 Consideration and adoption of modifications for the Operational Plan for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring
 - 8.2 Recommendations for further action required for the continued implementation of the Pilot Project on Marine Pollution (Petroleum) Monitoring and its eventual conversion into a regular monitoring programme
9. Any other business
10. Closure of the Workshop

ANNEX II

SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

RECOMMENDATIONS ADOPTED BY THE SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

The Second Workshop on Marine Pollution (Petroleum) Monitoring:

Having been informed

- that 36 countries have nominated National Co-ordinators for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring,
- that 12 Member States have reported on their activities within the Pilot Project,
- that at least four additional Member States have reported on their preparations for participating in the Pilot Project;

Noting

- that most participants have used techniques and procedures proposed by the first Symposium and Workshop on Marine Pollution (Petroleum) Monitoring in Gaithersburg, Maryland, USA, May 1974,
- that some significant difficulties in the quantification and exchange of data were reported,
- that some Member States had identified specific needs for training and technical assistance in order to participate or participate more effectively;

Expresses appreciation

- to several Member States for offering training opportunities,
- to the GIPME Task Team on Marine Pollution Monitoring for their helpful advice concerning the Pilot Project;

Concludes that

- sufficient potential and interest to participate in the Pilot Project exists to warrant its extension for two more years, but no more,
 - due to slow accumulation of data at RNODCs, a valid evaluation of the data is impracticable at this time, but should be started as soon as possible in order that the first experimental products may be made available by January 1977, to be used in a full scientific data evaluation by the end of 1977,
 - specification and implementation of intercomparison procedures are essential for the next period of the Pilot Project,
 - an extension of the Pilot Project will provide an opportunity for several additional developing countries to establish the capability to participate in it;
1. Recommends that Member States ensure, as a high priority action, that data collected within the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project be forwarded expeditiously to Responsible National Oceanographic Data Centres (RNODCs) in accordance with the Operational Plan for the Pilot Project and the IGOSS General Plan and Implementation Programme for 1977-1982 (IOC-WMO/IPLAN-III/3, Annex IV);
 2. Recommends to the IOC Working Committee for IGOSS and the WMO Executive Committee Panel on Meteorological Aspects of Ocean Affairs (MAOA)
 - 2.1 that the period of the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project be extended for two more years (January 1977-December 1978),
 - 2.2 that a third Workshop on Marine Pollution (Petroleum) Monitoring be held toward the end of 1978 to
 - review comprehensively the scientific result of the Pilot Project,
 - review the progress made by the countries that received training and technical support,
 - to advise on the future of marine pollution monitoring activities as envisaged by the Operational Plan.
 3. Recommends that the Secretariats of IOC and WMO take appropriate actions to implement the following recommendations related to the revised Operational Plan and to the envisaged development of the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project: 1)

1) Arranged in the most likely chronological order of implementation.

- 3.1 that the Revised Operational Plan IOC Manuals and Guides No. 7 "Guide on Operational Procedures for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring" be used with effect from January 1977;
- 3.2 that arrangements be made for training and technical assistance as a high priority action to facilitate a broadening of participation in the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project,
- 3.3 that intercalibration and intercomparison procedures and standard reference materials be prescribed as soon as possible together with a detailed manual on the methods of the Operational Plan to be made available to all participants,
- 3.4 that intercomparison and intercalibration exercises be organized within the context of the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project,
- 3.5 that an international format for the exchange of data arising from the Pilot Project be developed by the Chairman and Vice-Chairman of the IOC Working Committee on IODE, in collaboration with the participating RNOs and the Chairman of the IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project.
- 3.6 that arrangements be made for a Subgroup of Experts to meet not later than the end of 1977, to undertake an evaluation of data resulting from the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project and that the results of this evaluation be submitted to the Working Committees for IGOSS and GIPME.

ANNEX III

SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

REPORTS OF THE WORKING PANELS

(1) Report of the Panel on Sampling, Sample Preservation, Analytical Procedures and Standards

The Panel was composed of the following members:

Back, A. (Israel)
Balkas, T. (Turkey)
Carpine, C. (CIM/ICSEM)
Derenbach, J.B. (Germany, Fed.Rep.)
Duinker, J.C. (Netherlands)
Levy, E.M. (Canada), rapporteur
Michailov, V. (USSR)
Nesterova, M. (USSR)
Piyakarnchana, T. (Thailand)
Stegeman, J.J. (USA)
Zsolnay, A. (USA), chairman

This Panel first met with the Panel on Training and Technical Assistance in order to discuss the personnel, laboratory equipment and the kind of vessel needed for the different tasks contained in the Operational Plan. The result of this discussion is given in Annex III page 8.

This Panel addressed itself to Appendices II, III and IV of the Operational Plan (IOC-WMO/MFMSW-I) and its subsequent modifications proposed by the IOC/WMO Subgroup of Experts (see document IOC-WMO/MAPMOPP ad hoc-I/3 and IOC-WMO/MAPMOPP-I/3).

In Appendix II, Procedures for the Sampling and Reporting of Particulate Petroleum Residues (Tar Balls), only a minor change was introduced. Appendix III, Tar Sampling on Beaches, was completely re-arranged by Drs. Back and Duinker.

Appendix IV, Procedures for Sampling and Reporting Petroleum Hydrocarbons dissolved and dispersed in Sea Water, was also modified (any changes of the Operational Plan to date are now given in the revised version of the Operational Plan (IOC Series "Manuals and Guides No. 7").

Furthermore, the following recommendations were made:

- (i) The use of other analytical methods besides UV-fluorescence analysis such as gas chromatography should not be excluded. Gas chromatography provides much more information on the composition of samples, but it is not sufficiently sensitive for the low levels of hydrocarbons expected to be collected by the present method in other than highly polluted waters.
- (ii) The need for a standard is apparent, as is the need for determining what precisely is being measured by UV-fluorescence analysis. However, it will take perhaps several years to investigate these questions fully. In the meantime, there is a need for a suitable intercomparison material to eliminate or reduce possible differences in the sample processing and analysis in the different type of equipment employed. Such an intercomparison material must give an acceptable response at a given wave length, also the signal must be a linear function of the concentration over a reasonable range.
- (iii) A detailed manual for the analytical procedures involved should be developed during the next training course. It should include a listing of equipment and glassware needed.
- (iv) The Panel recognized that there were several important aspects of petroleum pollution monitoring which were still beyond the realistic capabilities of the Pilot Project, such as
 - sampling of surface micro-films for chemical analysis (see document IOC/GIPME-III/8 rev.)
 - sampling from greater depths for dissolved/dispersed hydrocarbons (see document IOC-WMO/MAPMOPP ad hoc-I/3)
 - sampling for dispersed tar particles (see document IOC-WMO/MAPMOPP ad hoc-I/3).

These aspects should be reconsidered by the IOC/WMO Subgroup of Experts after a 6 to 12-month period, at which time it may be decided if sufficient progress has been made in the Pilot Project to warrant the inclusion of further monitoring aspects. Research should be undertaken to develop and/or assess simple, fast, reliable and inexpensive methods for future stages of the Pilot Project. However, a decision on any expansion of the Pilot Project at the present time was considered to be premature.

(2) Report of the Panel on Visual Observations, Collection, Processing and Exchange of Data

The Panel was composed of the following members:

Gérhard, F. (France)
Ghannudi, S.A. (Libya)
Harb, M.S. El-Din (Egypt)
Hori, S. (Japan)
Kohnke, D.P. (Germany, Fed.Rep.), chairman
Norström, S. (Sweden)
Onuoha, G.C. (Nigeria)
Séméria, J. (Monaco)
Sobtchenko, E. (USSR)
Thompson, T. (Sweden), rapporteur
White, I.C. (UK)
Zrajevskij, I. (WMO)

The Panel reviewed the Operational Plan with respect to the visual observations (Appendix I), collection, processing and exchange of data (Appendices I to IV). The changes are contained in the revised Operational Plan (IOC Series "Manuals and Guides No. 7"). The work of the Panel is summarized as follows:

- (i) It was noted that the progress reports given by the National Co-ordinators at the Workshop had revealed a number of deficiencies, in particular those related to procedures for reporting on visual observations. Therefore, it was recommended that the instructions for completing the log forms as well as the code tables be improved, in order to secure more uniform reporting and to allow remote sensing data on surface oil films as well as visual aerial observations to be reported; however, no changes were made to the log forms themselves.
- (ii) It was noted that in spite of the recommendation in the Operational Plan, very few countries had forwarded data collected during the first phase of the Pilot Project to the Responsible National Oceanographic Data Centres (RNODCs), for subsequent generation of statistical summaries, archival and retrieval. It was, therefore, difficult to evaluate fully the actual progress of the Pilot Project. In order to overcome these difficulties, it was recommended that the participating countries be urged to send their data to at least one of the RNODCs for further processing and assessment. The RNODCs have to convert the data from log forms to a computer-readable format. Moreover, they should exchange the data, so that each centre has the complete set of data available on request.

- (iii) After having discussed in length the scientific needs and the results expected from the MAPMOPP observations, it was recommended that by 1 January 1977 products of the observations be prepared by the RNODCs on an experimental basis in order to assess the value of different statistical methods. The products should be produced in a form that will show (a) the areas polluted, (b) the intensity of the pollution and (c) the temporal and spatial variations of the different forms of oil pollution. It was also recommended that these products be circulated by the IOC-WMO Secretariats to the National Co-ordinators for MAPMOPP, to UNEP and to other international organizations, as well as to the Working Committees for IGOSS and GIPME for consideration. Comments on the products should be sent to the IOC and WMO Secretariats.
- (iv) It was agreed that international data exchange under the Pilot Project should follow the procedure established for observational data (BATHY and TESAC) in non-real time under IGOSS (IOC-WMO/IPLAN-III/3). In this context it was noted with appreciation that Japan and the United States of America have declared their readiness to give their NODCs the function of RNODCs for the data from the Pilot Project. However, other NODCs should be invited to participate in the exchange and processing of oil pollution data from the Pilot Project under the guidelines laid down in the Operational Plan.
- (v) It was recognized that an international format for the exchange of marine oil pollution data has not yet been established and that most of the participating countries during the pilot phase of the project will be unable to forward their data in a computer-readable format. Therefore, the RNODCs should accept the observations from participating countries in log forms as well as in a computer-readable format.
- (vi) Regarding the international exchange format still to be established there is an urgent need to develop and approve such a format. In this context appreciation was expressed for the proposal on the exchange format submitted by the Japan Oceanographic Data Centre (JODC). It was also noted that the Deutsches Ozeanographisches Datenzentrum (DOD) of the Federal Republic of Germany has already submitted its data related to visual observations to the RNODC (US-NODC) in computer-readable format. It was recommended that these two formats be brought to the attention of the Chairman and Vice-Chairman of IOC Working Committee on IODE, asking them to arrange for the two formats to be given urgent consideration in order to develop, in consultation with RNODCs and the Chairman of the IOC-WMO Subgroup of Experts on MAPMOPP, an appropriate international exchange format for MAPMOPP data. In case of acceptance by RNODCs, the format might be used prior to approval by the ninth session of the Working Committee on IODE.

(3) Report of the Panel on Training and Technical Assistance

The Panel was composed of the following members:

Durgham, A.A. (Libya)
El-Wakeel, S.K. (Egypt), chairman
Junghans, R.C. (USA)
Morris, B. (Bermuda), rapporteur
Orekoya, T. (Nigeria)
Van Hamme, J.H. (Belgium)

The Panel considered how to encourage the participation of developing member states in the Pilot Project. The non-participation of certain member states in the Pilot Project is explained by some lack of expertise in requisite sampling and analytical techniques. The concern of these member states, therefore, focussed on the need for training of personnel and technical assistance.

- (i) Training is recognized as a definite and immediate need. The panel urged that the implementation of a training programme which should be given high priority by the IOC-WMO Secretariats, be arranged within the member states who have facilities to offer; furthermore, that an immediate survey be taken among member states to assist in determining the necessary extent and duration of training courses, as well as the desirability of its repetition if demand exists and funds are available.

Personnel at scientific rather than technician level would be participating in training courses. The training of technical assistants would be the responsibility of the training course participants at their home laboratories. Review of the analytical procedures involved led the panel to conclude that technicians can, after basic training, perform the routine operations of the programme. Supervision, data handling and interpretation should be in the hands of trained and qualified scientists. Also, in order to ensure continuity in the national participation in the Pilot Project trained scientific supervisors will be essential.

According to these requirements, the objectives of a training course would be to provide a fundamental understanding of oil pollution based on physical, chemical and biological oceanography, resulting in the analytical steps to be designed according to the Operational Plan. The practical training should cover every aspect of the Operational Plan. Also, training should include data handling, transmittal and retrieval.

A first training course should be implemented during 1976. An offer has been received from Duke University, USA, to hold such a training course in 1976. The Bermuda Biological Station has also offered its facilities as an alternative site. There is a possibility that other institutions might be interested; this should be explored. However, such decisions should not delay the organization of a first training course beyond the present calendar year.

- (ii) Technical assistance is often a requirement of developing member states following participation by its scientists in training courses. This should be arranged through the Secretariats of IOC and WMO, during the setting-up and the actual data gathering of all the activities undertaken within the Pilot Project. These arrangements should meet the needs for equipment, its installation, initial operation and maintenance. Expert advice should be sought in such matters and be included in recommendations on choice of equipment, bearing in mind that any equipment selected for these laboratories should, wherever possible, be sufficiently versatile to serve other analytical needs. Finally, technical assistance should include follow-up visits by experts (on request), preferably in bi- and multi-lateral mutual assistance programmes. In this way, "trouble shooting" and quality control aspects can be covered.
- (iii) The Panel recommended that an agreement be signed by participants in training and technical assistance programmes to ensure subsequent participation by the trainees in the Pilot Project. Each participating member state should be required to commit both personnel and facilities to achieve the goals of the Pilot Project. Such commitments could be included in the form of a contract, a copy of which should be distributed to member states with an announcement of the training and technical assistance programme.

All available sources of training and technical assistance should be considered. Assistance should be requested from potential donor countries, through the Working Committee for Training, Education and Mutual Assistance in the marine sciences (TEMA) and the IOC and WMO Voluntary Assistance Programmes.

The Panel also felt that limitation of the Pilot Project to certain geographical areas should not be allowed to discourage developing countries from participation. Instead, the Pilot Project should allow for data acquisition in any ocean area. Potential participating member states should be given full training and technical assistance as recommended above.

- (iv) Anticipating that the Pilot Project will expand geographically over the next two years, and that additional countries will be able to participate after training and technical assistance has been provided, it was recommended that a meeting of the National Co-ordinators for the Pilot Project be convened by the end of the first year (1977) in order to review progress in the countries so assisted. Also a

workshop should be convened toward the end of the extended period (1978) in order to evaluate all the data acquired and submitted to RNODCs. At this workshop a clear decision should be reached on the date of termination of the Pilot Project in its present form or on its possible continuation as an operational programme.

In conclusion, the Panel urged that a training programme be initiated for the developing member states, and that considerations of subsequent technical assistance be given high priority. Bilateral, regional and multi-lateral co-operation in this framework should also be encouraged.

Attachment to the Report of the Panel on Training and Technical Assistance

The Panel on Training and Technical Assistance met jointly with the Panel on Sampling, Sample Preservation, Analytical Procedures and Standards. General specifications for personal qualifications and equipment needed by participants in the Pilot Project were developed. For the different tasks contained by the revised Operational Plan (IOC Manuals and Guides No. 7), these specifications are:

For tar ball sampling (Appendix II to the Operational Plan IOC-WMO/MPMSW-I)

Personnel - any able-bodied seaman who can understand and follow instructions for handling collection nets;

Equipment - Neuston nets of various designs and almost any type of sea-going vessel that can tow a net with a simple line;

For tar sampling on beaches (Appendix III to the Operational Plan IOC-WMO/MPMSW-I)

Personnel - anyone who can be given very basic instructions and can follow instructions;

Equipment - simple scraping and particle-collection devices, a sieve to separate the sand from the tar and a scale to weigh the collected material;

For water sampling (Appendix IV of the Operational Plan IOC-WMO/MPMSW-I)

Personnel - laboratory technicians for sampling and sample storage preparation;

Equipment - sampling devices and solvents; most vessels; so long as properly trained personnel are available;

For analysis of samples (Appendix IV of the Operational Plan IOC-WMO/MPMSW-I)

Personnel - trained junior scientists (and in some countries, engineers trained in operation of laboratory equipment) under supervision of qualified laboratory scientists;

Equipment - fluorescence spectrophotometer (scanning model preferred, but not mandatory) and basic laboratory equipment (e.g. glassware, fume-venting hood, etc.);

For analysis/assessment (Appendices I through IV of the Operational Plan IOC-WMO/MPMSW-I)

Personnel - working scientists familiar with petroleum contamination problems.

ANNEX IV

SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

LIST OF DOCUMENTS

A. Working Documents:

IOC/GIPME-III/8 rev.

Report of the ad hoc Task Team to consider recommendation IV of the IOC/WMO Joint Task Team II on the IGOSS Pilot Project on Marine Pollution Monitoring

IOC-WMO/MAPMOPP ad hoc-I/3

Summary Report of the ad hoc Meeting of the Joint IOC/WMO Subgroup of Experts on IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project, Kiel, Germany, Fed.Rep., 15-19 September 1975

IOC-WMO/MPMSW-I (Task Team II)

Operational Plan for the Pilot Project on Marine Pollution Monitoring under the Framework of IGOSS modified by the Joint IOC/WMO Task Team II on Marine Pollution Monitoring. NOAA, Rockville, Md., USA, May 1974

IOC/MPPP/3

Summary Report of the Expert Consultation on the Joint Co-ordinated Project on Pollution in the Mediterranean (including the operational plan for the IOC/WMO/UNEP Pilot Project on Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters), Msida, Malta, 8-13 September 1975

IOC-WMO/MAPMOPP-I/3

Summary Report of the first session of the IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project, London, 3-7 May 1976

B. Information Documents

IOC/IODE-VIII/12

Report of the ad hoc Group on Marine Pollution Data (with recommendations). Submitted by its Chairman to the WC for IODE. Paris, February 1975

IOC/GIPME-III/3

Summary Report of the third session of the International Co-ordination Group for the Global Investigation of Pollution in the Marine Environment (GIPME), Paris, 28 May-4 June 1975

NBS Special Publication, No. 409

Proceedings of a Symposium on Marine Pollution (Petroleum) Monitoring, Gaithersburg, Md., USA, 13-17 May 1974

GESAMP-VIII/4/1 prov.

Report of the Working Group on the Impact of Oil on the Marine Environment, second session, Rome, 17-24 September 1975 (restricted distribution)

GESAMP-VIII/4/2 prov.

The impact of Oil on the Marine Environment (Report of the GESAMP Working Group on the Impact of Oil on the Marine Environment, Part II: Resource Document on Impact of Oil on the Marine Environment) (restricted distribution)

C. Invited review lectures

IOC-WMO/MPMSW-II/L 1

E.M. Levy

Input of oil and its subsequent distribution in the marine environment

IOC-WMO/MPMSW-II/L 2

B. Morris

Environmentally induced changes on the petroleum

IOC-WMO/MPMSW-II/L 3

J. Stegeman

Ecological effects of oil

IOC-WMO/MPMSW-II/L 4

A. Zsolnay

Methodology instrumentation and standards for petroleum analysis in the marine environment

IOC-WMO/MPMSW-II/L Abs.

Abstracts of lectures presented at the Workshop (including the abstract of a lecture presented by Mrs. M. Nesterova on Hydrocarbons in Sea Surface Waters).

ANNEX V

SECOND WORKSHOP ON MARINE POLLUTION
(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

LIST OF PARTICIPANTS

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ANNEX VI

SECOND WORKSHOP ON MARINE POLLUTION

(PETROLEUM) MONITORING

Monaco, 14-18 June 1976

LIST OF ACRONYMS

ALECSO		Arab League Educational, Cultural and Scientific Organization
BATHY		Bathythermograph report
CIM	(of IOC/ICSEM/ FAO (GFCM))	Co-operative Investigations in the Mediterranean
DOD		Deutsches Ozeanographisches Datenzentrum (German Oceanographic Data Centre), Hamburg
GEMS		Global Environmental Monitoring System
GESAMP		Group of Experts on the Scientific Aspects of Marine Pollution
GIPME	(of IOC)	Global Investigation of Pollution in the Marine Environment
GLC		Gas-liquid chromatography
ICSEM		International Commission for the Scientific Exploration of the Mediterranean
IDOE		International Decade of Ocean Exploration
IGOSS	(of IOC/WMO)	Integrated Global Ocean Station System
IHO		International Hydrographic Organization
IOC		Intergovernmental Oceanographic Commission
IODE	(of IOC)	Working Committee on International Oceanographic Data Exchange

JODC		Japan Oceanographic Data Centre
MAOA	(of WMO)	WMO Executive Committee Panel on Meteorological Aspects of Ocean Affairs
MAPMOPP	(IOC/WMO)	Joint IOC/WMO Subgroup of Experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project
NBS	(USA)	National Bureau of Standards
NERC	(UK)	Natural Environment Research Council
NODCs		National Oceanographic Data Centres
RAMOGE		Regional Pollution Studies in the Ligurian Sea (France-Italy-Monaco)
RNODCs		Responsible National Oceanographic Data Centres
TEMA		Working Committee on Training, Education and Mutual Assistance in the marine sciences
TESAC		Temperature, Salinity and Currents report
UNEP		United Nations Environment Programme
UV		Ultra violet
VAP	(of IOC)	Voluntary Assistance Programme
WMO		World Meteorological Organization