MANUAL FOR MONITORING OIL AND DISSOLVED/DISPERSED PETROLEUM HYDROCARBONS IN MARINE WATERS AND ON BEACHES

Procedures for the Petroleum Component
of the IOC Marine Pollution
Monitoring System (MARPOLMON - P)

PREFACE

In response to a recommendation of the United Nations Conference on the Human Environment (Stockholm, 1972), IOC and WMO agreed to undertake jointly the design, planning and development of a marine pollution monitoring programme. As an initial step in this direction, a Pilot Project on Marine Pollution (Petroleum) Monitoring (MAPMOPP) was launched in 1975 within the framework of the Integrated Global Ocean Station System (IGOSS) and aimed at monitoring petroleum-derived oils. The results of this project were published in "Global Oil Pollution; results of MAPMOPP, the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring" (IOC, Paris 1981).

Upon the successful completion of this project, the IOC Assembly decided (by Resolution XI-5) to initiate a Marine Pollution Monitoring System (MARPOLMON), which now falls within the framework of IOC's programme for the Global Investigation of Pollution in the Marine Environment (GIPME). This manual relates to one operational element (petroleum pollution monitoring: MARPOLMON-P) of this programme. The activity is being conducted as an extension of MAPMOPP, and its implementation will be followed by that of non-oil pollutants, in due course.

The conceptual and operational framework as well as the general guidelines for the implementation of MARPOLMON-P are contained in "The Operational Plan for the Petroleum Component of the IOC Marine Pollution Monitoring System (MARPOLMON-P)" in the IOC Manuals and Guides Series.

The present document describes the procedures for field sampling and observations, laboratory analysis, data reduction and reporting for the petroleum component of the IOC Marine Pollution Monitoring System (MARPOLMON-P). The procedures described are based on those contained in IOC Manuals and Guides No. 7 (Unesco 1976), and refined by the GIPME Group of Experts on Methods, Standards and Intercalibration (GEMSI).

Participants in MARPOLMON-P are urged to adhere as closely as possible to the methods described herein. All of these methods have been extensively tested in the field and in the laboratory and have been demonstrated to be relatively simple to use, yet yield results of acceptable comparability.

The Manual will be periodically reviewed and amendments or additions will be issued when warranted.

Any inquiries or suggestions concerning this Manual should be directed to the :
Intergovernmental Oceanographic Commission
Marine Pollution Research and Monitoring Unit
Unesco
Place de Fontenoy
75700 Paris
France

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A.   PROCEDURES FOR SAMPLING AND REPORTING DISSOLVED/DISPERSED
       PETROLEUM HYDROCARBONS IN SEAWATER

INTRODUCTION

The MARPOLMON-P procedure for the determination of dissolved/ dispersed petroleum hydrocarbons in sea water is based on similarities between the fluorescence excitation and emission spectra of non-polar organic substances extracted from sea-water and those present in most crude and residual fuel oils. The latter are characterized by a maximum excitation around 310 nm and broad peak around 360 nm in the emission spectrum. These features are primarily a reflection of the complex mixture of compounds containing two or more aromatic rings.

The procedure entails the collection of water from 1 m depth using a weighted glass bottle, extraction of the non-polar organic substances with pure hexane, and quantification by fluorescence spectrophotometry. The procedure is not only highly sensitive and reasonably selective, but at the same time is simple, rapid, and straightforward. However, the material extracted from the sea water is not "oil" but the accumulated products of oil degradation with possible contributions from non-polar aromatic compounds derived from other sources. Because of the complexity and ill-defined nature of this material, a fully satisfactory reference material for quantifying it by fluorescence spectroscopy is not presently available. Therefore, analysts are instructed to use chrysene as the primary reference material. Other oil products may also be used as reference materials where appropriate and a procedure for determining intercomparison ratios between chrysene and standard reference oils is specified. Thus, all MARPOLMON-P data is to be expressed in terms of "chrysene equivalents" with the understanding that it is neither chrysene nor oil that is being measured, but rather, a complex mixture of materials better referred to as "petroleum residues".

In the future, a "standard oil" may be specified in addition to chrysene for use as a calibration material. Specification of the fluorescence analysis as the basic measurement for DDPH to be made in MARPOLMON-P programmes does not preclude the use of additional, more selective analytical methods when available to the analysts. A description of additional recommended methods can be found in IOC Manuals and Guides No. 11 (The Determination of Petroleum Hydrocarbons in Sediments).

CAUTION: Since the concentration levels of dissolved/dispersed petroleum hydrocarbons in the marine waters are generally in the range of microgrammes per litre, great care must be taken to avoid contamination of samples throughout the entire procedure.

1.   SAMPLING

1.1.   SAMPLING DEVICE AND PROCEDURE

A device such as that illustrated in Figure 1 is recommended for collecting water samples. It consists of a weighted bottle holder with a clean amber-glass bottle of 3-4 litres capacity (an amber 1 gallon solvent bottle is excellent). The bottle should have a small mouth (2-3 cm inside diameter) so that it will fill slowly and have time to sink below the surface before filling. Prior to use, the bottle should be thoroughly cleaned and rinsed according to the following procedure.

- wash with detergent
- rinse with tap water
- rinse with acetone or methylene chloride
- rinse with nanograde hexane

If possible, the UVF signal of the last solvent rinse should be determined to ascertain whether the bottle is clean. If the UV signal cannot be measured on site, the last rinse should be submitted along with the sample set to be analyzed as a sample container blank.

Prior to cleaning, the bottle cap should be fitted with a liner made of teflon. This prevents contamination of the sample by unsuitable bottle cap materials. When ready for deployment, the cap should be removed and the bottle should be attached to a float by a line of 1 m length (see Fig. 1).

A second retrieving line should be attached to the float and should be used to pull the bottle back on board the ship after the sample has been taken. The assembly should be thrown overboard from the bow of the ship, nearly at a complete stop, and drifting slowly forward. It should be thrown as far as possible away from the ship to avoid water that has been disturbed or contaminated by the ship. The bottle will sink immediately to 1 m and slowly fill with water. The bottle should be retrieved at once. (Other proven sampling devices such as a precleaned stainless steel Bodman or other non-contaminating bottle could be used if available. If other sampling devices are used, the required amount of seawater should be drained directly into the glass sampling bottles taking extreme care to avoid sample contamination from the additional handling.)

Upon retrieval, approximately 75 ml of water should be discarded from the sample bottle to allow room for expansion and solvent addition. The amount discarded may have to be increased for samples from cold waters which require larger expansion volumes. If possible, 50 ml of nanograde hexane should be added immediately. After insuring the cap liner is intact, the bottle is capped and labelled. Samples must be stored cool, in the dark, and extraction should begin as soon as possible after collection in order to avoid microbial degradation of the sample.

1.2. RECORDING OF SAMPLES

To identify the samples, a log must be maintained, noting the position, in degrees and minutes of latitude and longitude, the date and the local time. Specified environmental data should be given when possible. The code tables with explanations are provided in Annex I. Log Form for Sampling, Analysis and Reporting Dissolved/Dispersed Hydrocarbons is given in Annex II. A label (format specified in Annex II) should be attached to the sample bottle bearing the sample number from the log and the position, data and time of sampling.

If samples are collected from depths greater than 1 metre, enter depth of sampling in the "Remarks" space of the log form and use the Data Documentation Form (Annex II), to indicate methods used for sampling.

1.3. DISPATCH OF SAMPLES

Sample bottles, together with a copy of the logs should be packed securely in a transit case and sent (see below concerning extraction) to the appropriate analytical laboratory.

2.   PROCESSING AND ANALYSIS

2.1.   EXTRACTION

Sample extraction should be performed as soon after collection as is possible. Ideally, this should be done at sea if conditions and space permit. Otherwise it should be done as soon as the vessel reaches shore. Samples should never be stored more than 3-4 hours before solvent addition and they should be kept in the dark and cool during storage. The extraction is performed with pure hexane of nanograde or HPLC grade. Note further considerations on purity as described in section 2.3. If there is some doubt as to the quality of the solvent after long storage, it can be cleaned by adding 5 ml of concentrated H_2SO_4 per litre, shaking, and allowing it to stand overnight. The acid will sink and the solvent can be poured off the top.

One hundred ml of hexane is used in two successive 50 ml extractions and the extracts are combined. There are several convenient methods for doing this.

2.1.1.   Pipette method

After addition of the first 50 ml aliquot of hexane, the bottle cap with intact liner is replaced and the entire sampling bottle shaken vigorously. After a few seconds, the bottle is placed upright and the cap loosened lightly, and slowly, to allow hexane vapour to escape. This process is repeated for about 5 minutes. The bottle is then placed upright and the hexane phase allowed to separate. The hexane should be in the narrow neck of the bottle. If necessary, a measured volume of pre-extracted water may be added to lift the hexane layer to a suitable height. Then a clean hexane rinsed pipette is used to withdraw the hexane phase and transfer it to a clean hexane rinsed glass-stoppered storage bottle. (It is convenient to carefully measure the length of pipette needed to reach to the solvent-water interface and then place a pinch clamp on the pipette to mark that length). The extraction is repeated with a second aliquot of 50 ml of hexane. The glass-stoppered bottle containing the hexane extract is then labelled, visible quantities of water removed from the bottom with a clean pipette, a few grammes of pre-cleaned anhydrous Na_2SO_4 added to dry the extract, and stoppered and stored for further analysis.

Sodium sulphate should be cleaned by Soxhlet extraction with methanol in pre-extracted glass-fibre thimbles. The extracted Na_2SO_4 is transferred to a clean glass beaker and dried at 150°- 200°C in a clean oven. Meeting this latter requirement is of great importance, since the Na_2SO_4 may absorb vapour from contaminated atmospheres. Cool the Na_2SO_4 in a clean dessicator whose ground glass surfaces have not been greased.

2.1.2.   Separatory funnel method

This method requires two clean, hexane-rinsed 2 litre capacity separatory funnels with Teflon stopcocks and stoppers. Assuming a four-litre sample, the following procedure is used for extraction. Half the sample is poured into separatory funnel No. 1. If hexane has not already been added after sampling, 50 ml of hexane are added to the separatory funnel. The funnel is then shaken vigorously, held upright and the cap loosened to allow hexane vapour to escape. This process is repeated for about five minutes after which the funnel is placed in a rack and the hexane phase allowed to separate from the water. The water phase is then drained into funnel No. 2. Then 50 ml of fresh hexane is added to funnel No. 2 and the extraction process repeated.

After allowing the hexane phase to separate in funnel No. 2, the water is drained and discarded. The second half of the sample is then added to funnel No. 1 (which still contains the first 50 ml of hexane), shaken, allowed to separate and the water phase drained into funnel No. 2, where it is shaken again, allowed to separate and the water phase drained off and discarded. The 50 ml of hexane in funnel No. 1 is then drained into the sampling bottle, which is rinsed, and the hexane then transferred to funnel No. 2. To the combined extracts in funnel No. 2, a few grammes of pre-cleaned anhydrous Na_2SO_4 are added to break any emulsion and to remove excess water. Once the extract is chemically dried, it is then drained into a clean, hexane rinsed, glass stoppered bottle, labelled and stored for analysis. Great care must be taken to exclude Na_2SO_4 in the final extract.

2.1.3. Separatory funnel applied to sampling bottle

One hundred ml of seawater are removed from the sample bottle, 50 ml of hexane are added, and the bottle is shaken vigorously for some seconds. The screw cap is loosened for pressure equilibration, fastened again and the shaking continued for 5 min. After extraction, the normal screw cap is replaced by a Teflon screw cap carrying a separatory funnel equipped with a three-way stopcock and a long-stem funnel which ends near the bottom (see fig. 2). This appliance can be manufactured easily by a competent workshop. Extracted seawater is added to the bottle through the long-stem funnel. With proper positioning of the three-way stopcock; the hexane layer is thus forced into the separatory funnel usually together with some water and sometimes as a froth.

If the phases refuse to separate, a few millilitres diethyl ether are added, the separatory funnel is removed from the screw cap and shaken. This action usually breaks the emulsion. The aqueous phase is drained and the organic phase is collected in a 100 ml glass flask. The extraction procedure is repeated once. The combined extracts are dried with anhydrous sodium sulphate, while the flask is capped. The dried extract is transferred into another 100 ml flask and reduced in volume to a few millilitres in a rotary evaporator (reduced pressure, bath temperature<30 °C).

2.2. EXTRACT CONCENTRATION

The hexane extracts or blanks (see below) are reduced in volume to less than 5 ml by using a rotary evaporator or by gentle heating on a hot plate maintained at less than 68 °C. If heat is used, the extract must never boil. The reduced extract is carefully pipetted into a pre-cleaned 5 ml graduated glass container, making sure any residual particles of Na_2SO_4 are excluded. The bottle is then rinsed with fresh hexane and the rinsings used to make the sample volume up to exactly 5 ml. The sample is then ready for fluorescence measurement.

The concentration process is critical because of the danger of loosing the low-boiling aromatic hydrocarbons which often give a major contribution to the fluorescence signal. Thus, extracts should not be taken to dryness unless necessary for transporting sample extracts. If this is required, the final 2 ml of the hexane extract should be evaporated at temperatures below 35° C. This is achieved at room temperature or under a gentle stream of purified nitrogen gas. Where solutions are to be concentrated by rotary evaporation insertation of a solvent trap between sample flash and rotary evaporator, (see Figure 3) will help in protecting the sample from contamination otherwise possibly introduced with refluxing solvent.

2.3.   ⌐LANKS

Whatever extraction method is used, great care must be taken throughout the entire procedure to ensure that samples are not contaminated. For example, avoid unnecessarily exposing the water sample, the solvent and glassware to the atmosphere or other potential sources of contamination. Complete procedural blanks must be run by carrying 100 ml of hexane through the entire extraction procedure, including adding the same amount of Na_2SO_4 used to dry samples and by using all the glassware employed for sample extraction but without water. Blanks should be run at the same location and at the same time as extractions. When blanks show contamination by fluorescence analysis, the sources of contamination should be eliminated rather than correcting the data with an unreasonably high blank value.

The quality of the extraction solvent is of crucial importance and must be checked frequently. The hexane must be a pure grade and free of fluorescing contaminants. The hexane is acceptable for extractions if, after concentration from the same volume used in sample extractions, its fluorescence emission at the selected wavelength (see below) does not exceed a maximum of 5 percent of the full-scale deflection when the fluorometer is in the highest sensitivity setting before use. If it does not meet the fluorescence purity test it must be cleaned with acid as described in Section 2.1 (Extraction). The complete procedural blank value is acceptable for sample correction if its fluorescence reading does not exceed twice the fluorescence of the hexane blank.

2.4.   PREPARATION OF STANDARDS

One set of standards must be chrysene in hexane since the results reported to MARPOLMON-P must be in terms of chrysene fluorescence units. This is to allow intercomparison of data sets. However, before the standard chrysene is used for calibration, its correct emission spectrum must be verified. This is done by exciting the chrysene solution at 310 nm and recording its emission spectrum. The correct spectrum will show emission maxima near 362 nm and 381 nm and a smaller maximum near 408 nm.

(Note: The spectrum of chrysene solutions has been shown to vary between different instruments and settings. It is for this reason and because of the steepness of the slope of the emission spectrum near the quantification wavelength that a standard oil may be specified for calibration.)

A stock solution is prepared by dissolving 1.0 mg chrysene per 100 ml of hexane.

(Note that chrysene is quite soluble but the kinetics of solution are slow. Therefore adequate time must be allowed to ensure complete dissolution. Stock solutions should stand at least overnight before dilution.)

From this solution a range of standard solutions is prepared. The required range will depend on the sentivity of the fluorometer. Under the conditions specified for analysis, modern instruments will give a linear response up to a chrysene concentration of approximately 2 to 3 ug ml^{-1}. Thus, a useful set of standards would be 0.1, 0.2, 0.5, 0.7, 1.0, 2.0, 3.0 ug ml^{1}. At least 100 ml of each solution should be prepared to allow adequate supply. Thus, at least 300 ml of the stock solution should be prepared.

Standards can also be prepared from refined or crude oil. The fluorescence efficiency of oils varies and is generally much less for oils than for chrysene. However, it may be important for individual analysts to have results expressed in terms of oil units. This is especially applicable to tracing oil spills where a sample of the spilled oil is available for calibration. Oil standards are prepared in much the same way as chrysene standards. Oil is weighed and transferred to a volume of hexane so that the stock solution is approximately 0.5 mg oil per ml of hexane. This stock solution is then used to prepare standard solutions in the linear response range. Hard-to-dissolve oils, such as Kuwait Crude, will require that the primary stock solution be less concentrated than the values given here. The standards are run in the spectrofluorometer at the same sensitivity setting as the chrysene standards are run. After a calibration curve is prepared (see below) an intercomparison ratio (R) is then calculated from the chrysene and oil standardization curves according to the formula :

$$R = \frac{\text{fluorescence intensity of chrysene standard} \quad X \quad \text{concentration of oil standard in } \mu g \text{ ml}^{-1}}{\text{fluorescence intensity of oil standard} \quad X \quad \text{concentration of chrysene standard in } \mu g \text{ ml}^{-1}}$$

When such an R is available for a pertinent oil, it should be reported on the back of the Data Documentation Form (see below) along with a description of the oil and its source.

2.5. FLUORESCENCE MEASUREMENT AND CALIBRATION

2.5.1. Measurement procedure

Aliquots of the hexane solutions of blanks, standards and samples are pipetted in turn into a teflon-capped 1 cm silica fluorescence cell. The basic quantitative measurement is made by measuring emission intensity at 360 nm with excitation set at 310 nm and monochromator slits at < 10 nm. All blanks, standards and samples should be run at identical instrumental settings and conditions. The wavelengths specified have been determined to be acceptable for measuring the fluoresence of several crude and residual fuel oils. A plot of intensity of emission versus concentration should be linear to a concentration of approximately 3 ug ml^{-1} for chrysene. Fluorescence intensity of samples should be measured within the linear range.

2.5.2. Calibrations

Calibrations should be run at least once a day. If possible, both the excitation and emission spectra should be scanned for each sample. If equipped with synchronous scanning, analysts are encouraged to use it to gain structural information on samples. Recommended wavelength difference is 23 to 25 nm with a band-pass width of < 10 nm.

2.5.3. An alternative calibration procedure

A hexane solution of oil is prepared so that 5 μl added to 2 ml of clean hexane in the fluorometer cuvette is equivalent to 1 μg of oil per litre of seawater. With a reagent bottle with a volume = V ml and a concentration of 1 μg of oil per litre of seawater, V μg of oil would finally be contained in 5 ml of hexane, if a 5 ml volumetric flask was used. The concentration would then be V/5 μg per ml. A convenient volume to pipette into the fluorometer cuvette is 2 ml. Further, 2xV/5 μg of oil

will have to be added to precisely 2 ml of clean hexane to produce a concentration equivalent to 1 μg of oil per litre of seawater, if a V-litre sample bottle was used. These 2xV/5 μg should be dissolved in 5 μl of hexane, because 5 μl increments are added conveniently with a 10 μl syringe, and the addition is negligible compared to 2 ml in the cuvette. The concentration of the standard solution thus should be 2xV/5x20 mg of oil per 100-ml of hexane, in a volumetric flask.

The actual calibration is performed as follows. Two ml of hexane are pipetted into the fluorometer cuvette. The blank fluorescence at 360 nm is determined with 310 nm excitation. Five μl of the standard oil solution are added with a 10 μl micro-syringe. The cuvette is carefully removed from its holder in the instrument and swirled gently to distribute evenly the added standard. The fluorescence is measured. This process is repeated 5 to 10 times to produce fluorescence readings equivalent to 1-5 or 1-10 μg of oil per litre of seawater.

2.6. CALCULATION OF SAMPLE CONCENTRATION

The concentration of DDPH in the sample extract, in chrysene units, is read from the chrysene calibration curve and corrected for any blank fluorescence. The original sample concentration in chrysene equivalents is then calculated according to the formula :

$$\text{Concentration of DDPH in original sample} = \frac{\text{concentration in sample extract } (\mu g\ ml^{-1}) \times \text{extract volume(5ml)}}{\text{volume of original sample in litres}}$$

The result is the chrysene equivalent concentration in μg l^{-1}.

2.7. TESTING FOR INNER FILTER EFFECTS

The intensity of the emitted fluorescence that is measured with the fluorometer is a function not only of the character and concentration of the fluorescent compounds in the sample, as well as the dimension of the sample in the light path of the photometer, but also of the intensity of the excitation source.

There is a linear relationship between the sample concentration of fluorescing compounds and the intensity of the emitted light only when the total absorption of the sample is low. If the absorption exceeds 0.05 absorbance units (less than 95% transmittance), fluorescence intensity will be reduced by the presence of any compound that can absorb either the excitation light or the emitted light. As this takes place in the sample cell itself, the disturbance is called "inner filter effect". At high concentrations this can be caused by the fluorescing compound itself (e.g. samples from a sea area with heavy oil pollution). More commonly, especially when working with estuarine or coastal waters, or with open sea waters during periods of high primary productivity, it is the presence of other organic substances in large concentrations that is troublesome. These substances must be eliminated by a clean-up procedure or their presence in samples corrected for by the standard addition procedure described below.

The presence of substances co-extracted with the oil in samples may cause "quenching". This can be described as an interaction between an excited sample molecule and a molecule of a quenching substance. In this interaction, energy is transferred to the quencher rather than being transformed into a fluorescence emission.

The result of inner filter effects and/or quenching in samples is a reduction in the fluorescence emission that should occur from the content of petroleum residues. In extreme cases the emission may be totally cancelled. If analyses give unreasonably low results, or if totally unknown samples are analysed, it is good practice to check for the presence of inner filter effects or quenching by conducting the following simple experiments. None of these experiments will be fully conclusive in every case, and a good knowledge of fluorometry is in some cases required for their application and correct evaluation.

2.7.1. Raman-scattering test

This test can help to reveal inner filter effects but not quenching. A test with the Raman-scattering peak will work only if that peak is isolated from the emission band of the petroleum hydrocarbons. If the Raman peak is riding on the slope of any other emission peak, the test is not conclusive.

Use 270 nm as excitation wavelength. Replace the sample cell with a cell containing pure hexane. Scan, mechanically or manually, the emission spectrum to find the maximum of the Raman-scattering peak which should appear close to 297 nm. (In order to resolve the Raman and Rayleigh scattering peaks, narrow slit widths and high sensitivity settings must be used on the fluorometer.) The spectrum should be recorded. Replace the sample cell and scan in the same way to find the Raman peak, which should be of almost equal intensity as that for the pure hexane. If the peak is significantly lower, an inner filter effect is present and the sample must be diluted or subject to a clean-up procedure.

2.7.2. Sample dilution

Make a series of dilutions of the samples with pure hexane and measure their intensities at 360 nm. Plot the measured intensities versus the diluted concentration. If a straight line relationship is obtained, there is no inner filter effect and the original sample can be used for the quantitative measurement. If the relationship is not linear, dilute the sample until a linear relationship is obtained and use the dilution on the linear portion of the graph for the quantification.

2.7.3. Standard addition

Measure the fluorescence intensity of the sample. Then dilute it with an equal volume of a standard chrysene or oil solution that has nearly the same fluorescence intensity as the sample. Then measure the fluorescence intensity of the standard-plus-sample mixture. The fluorescence of the mixture should be equal to:

$$\text{Fluorescence of mixture} = \frac{\text{fluorescence of standard solution}}{2} + \frac{\text{fluorescence of sample extract}}{2}$$

If the fluorescence of the mixture is less than that predicted by more than 20%, then significant inner-filter effects are occurring. A correction factor is calculated by dividing the predicted fluorescence for the mixture by the observed fluorescence for the mixture. Intensity of the sample emission is then multiplied by this correction factor for the sample quantification.

2.8.   SAMPLE CLEAN-UP

Further sample manipulation involving column chromatography or other clean-up procedures is discouraged because of the possible introduction of contamination and variability in small-volume water samples. Several simplified procedures were tested in analysis of offshore and coastal waters and shown to be generally unnecessary.

3.   COMPLETING AND FORWARDING OF REPORTING FORMS

Two reporting forms should be sent through the National Co-ordinator (or with a copy to him, if so agreed) to one of the Responsible National Oceanographic Data Centres (RNODC) (see Annex II). They are : the "Log Form for Sampling, Analysis and Reporting Dissolved/Dispersed Hydrocarbons", and a "Data Documentation Form". The two forms are to be used together. Details of how to complete the form are given in Sections 1.2 and 2.4. Remember that concentrations on the Log Form should be reported as chrysene equivalents. If standard procedures are adopted, indicate "standard techniques".

B.   PROCEDURES FOR THE SAMPLING AND REPORTING OF PARTICULATE
         PETROLEUM RESIDUES (TAR BALLS)

INTRODUCTION

The rationale of sampling floating tar is to determine the standing stock of these materials in the open ocean. The 'standard' method is to use a neuston net to trap tar particles floating on the sea surface, while recording geographical location and area covered, and convert this to mg m^{-2} of ocean surface. Spatial variability in distribution creates inherent problems with the method. Adequate coverage of an area conducted over a period of time enables an appraisal of the state of oceanic pollution by tar balls. Tar measurements supplement information gained by beach tar collections and visual observations.

The method, as described below, will produce data in such a form that it can be incorporated in the data forms for RNODC. The collection of supplementary meteorological and oceanographic data (winds, currents, etc.) is extremely important to the interpretation of results and must also be collected during sampling.

1.   SAMPLING DEVICES

Any neuston sampler is suitable if used correctly; i.e., properly deployed and towed at its optimum speed. Nets fitted to the sampler should be of the plain nylon web type.

Information on procedures and suitable neuston samplers is to be found in Sameoto and Jaroszynski (1969), Derenbach and Ehrhardt (1975), David (1965) and Unesco (1974).

2.   AREAS FOR MONITORING

The programme covers all ocean areas.

3.   FREQUENCY OF SAMPLING

Samples should be taken daily from ships in transit, if arrangements can be made. From more permanent stations including Ocean Weather Ships, sampling should be done on a weekly-to-monthly basis.

Samples may be taken day or night, although daytime sampling will reduce the amount of organisms sampled. It is desirable (but not essential) to collect a water sample for measuring dissolved/dispersed hydrocarbons at the location where the tar sampling is carried out.

4.   SAMPLING PROCEDURE

4.1.   The sampler should be rigged so that it will go off to the side of the ship and pass through a surface that has not been greatly disturbed by the ship; i.e., tow from a point well forward on the ship, preferably from a boom.

Bridles must be attached to the side of the sampler nearest the ship. They are to be adjusted, depending on the elevation of the towing point on the ship so that the sampler rides smoothly.

4.2.   Adjust towing speed so that the sampler rides smoothly on the surface for at least 1 nautical mile (depending on the sampler used). If wave conditions do not allow a smooth ride, record average time that the sampler's muzzle is above or below the surface (instead of sampling it) per time unit, and correct the value of the area swept accordingly.

To eliminate the various hydrometeorological and dynamic factors that might affect the homogeneity of the sampling, the sampling may be made while the ship sails in a full circle, if necessary.

4.3.   At completion of tow, retrieve sampler, wash contents down to the end of the net and empty it into a fine sieve. If the net contains an undue amount of extraneous material, it should be emptied into a clean bucket containing water. Recover tar balls from the sieve or from the bucket and place them in a glass jar.

4.4.   If fresh sticky oil adheres to the net in quantities exceeding approximately 10% of the sample taken, wash the net with a suitable solvent and retain the washings in a jar.

The solvent used to clean the net should be one that leaves no residue upon drying; this solvent should be named on the jar label under "comments".

In case quantitative recovery of the tar sticking to the net surface is impossible, record its estimated concentration in percentage of the total sample.

4.5.   Label the glass jar containing the sample according to the example given in Annex II. The estimated amount of the sample lost to the net surface is to be recorded under "comments".

5.   PRESERVATION OF SAMPLES

Freezing of samples is recommended; if this is impracticable, refrigerate the samples.

6.   RECORDING OF SAMPLING

Record location, time, sea conditions and other pertinent information on the log form as given in Annex II. Code tables for use with this log can be found in "Code tables with explanations" in Annex I.

7.   DISPATCH OF SAMPLES

Labelled sample jars, together with the log, should be packed securely in a transit case and sent to the appropriate analytical laboratory specified by the National Co-ordinator.

8.   DETERMINATION OF WEIGHT

8.1.   If the tar balls have been separated manually from the larger particulate matter also sampled, they may be weighed directly. However, this weight may include inorganic materials such as sand or bits of shells and any water contained in the tar balls. A more reliable estimate may be obtained by proceeding as outlined in 8.2. below.

8.2.   If it is not possible to separate the tar balls manually from extraneous material :

- Dissolve the tar balls in carbon tetrachloride.

- Recover the carbon tetrachloride extract and evaporate to dryness; the solvent used to clean the net (as in item 4.3), above) should also be evaporated. In both cases the evaporation may be hastened by mild heating, but actual boiling should be avoided since there will be some loss of volatile components. The operation should be carried out under a fume hood or in an area with good ventilation.

- Weigh the residue.

9.   COMPLETING AND FORWARDING OF LOG FORMS

The weight of the tar measured is entered in the log column "weight of tar". Enter the calculated weight of tar per area swept by the sampling net in the column "tar concentration".

The completed log forms should be forwarded to an address specified by the National Co-ordinator, normally the RNODC for this programme (see Annex II).

C.   <u>TAR SAMPLING ON BEACHES</u>

INTRODUCTION

The following method is intended to assess the standing stock of tar on beaches. Surveys conducted on a regular basis can be used to establish seasonal or long-term trends in the amount of tar deposited on shores. Tidal and wave action tend to redistribute tar lumps on shores. Thus, studies to assess the absolute deposition rate would have to be conducted by precleaning the entire surveyed beach followed by routine collection of all tar deposited over specified time intervals. Results of pilot monitoring projects using the method described here have shown that the amount of tar collected per metre of beach face was greatest for sandy beaches; presumably because the same processes, such as currents, which led to the accumulation of sand also affected the relative deposition rate of tar. Tar accumulation appeared to be dependent on pollution load, transport processes, such as winds and currents, and meteorological processes, such as evaporation, which control residue density. Results should be reported in terms of linear metre of beach front to allow intercomparison of beaches with widely differing slopes. Meteorological observations should accompany results as indicated in the log forms.

1.   SELECTION OF SAMPLING AREA

The sampling should take place on a beach having a relatively smooth surface with :

- a uniform shoreline (no breakwaters or cuts);
- a gentle slope;
- a minimum of human activity, such as foot traffic, etc.;
- no local land-based sources of petroleum pollution (otherwise, specify in the Remarks coloumn of the log form).

2.   SIZE OF SAMPLING ZONE

Tar should be collected at a few stations along the coast. At each station three randomly chosen narrow strips of 1-2 metres width are sampled, running across the beach from the backshore to the low-tide mark.

If uniformity of tar distribution in a given area has been established, by statistical analysis of either air photography data or tar data, the number of strips per station can be reduced to one. If different areas can be differentiated with respect to such parameters as the amount or type of oil, the data from these different areas should not be pooled.

3.   FREQUENCY OF SAMPLING

Sampling should take place at least every two weeks.

4.   DURATION

One year, to start at any time of the year.

5.   SAMPLING PROCEDURES

Stake out a sampling area as proposed in item 2 above. Sample only at or near the time of low tide. Pick up all visible solid and semi-solid pieces of tar. Since tar is frequently disguised by beach sand, debris, pebbles, etc., the participant must sift through this material by breaking up the beach surface to a depth of approximately 2 cm using fingers or a rake.

In heavily polluted areas where picking up tar whould be too time consuming, sample by brushing the upper 2-3 cm of the selected strips, using a long handled floor brush and a rake. The piles created, which consist of sand, tar, and other particles, are then sampled and washed free of sand with water, using a screen with a 2 mm mesh.

6.   QUANTIFICATION

This is easily done when dealing with clean tar lumps. When tar particles are heavily covered with sand, cleaning is not advisable. In this case, it is suggested that the volume rather than the weight be measured: Put tar particles in a graduated cylinder. Add water so that all particles are covered. Read volume. Decant water into a second graduated cylinder. Subtract smaller from larger volume of water displaced, assuming a density of 0.85 g ml^{-1}(multiply difference by 0.85).

In heavily polluted areas with hundreds of grammes of tar per square metre of beach, it may be practical to separate tar particles into two fractions, using a sieve with a 1 cm mesh size. The tar contained in each fraction is measured as described above. The amounts are then added and entered in the log form.

7.   SAMPLE RECORDING

A log form for recording of sampling and reporting tar on the seashore, with explanatory notes, is given in Annex II.

D.   OBSERVATION OF OIL SLICKS AND OTHER FLOATING POLLUTANTS

1.   MAIN OPERATIONAL FEATURES

1.1.   GEOGRAPHICAL COVERAGE

The Programme covers all ocean areas.

1.2.   FREQUENCY OF REPORTING

It is desirable that the continuous watch kept should also report visible pollutants. Whenever floating oil, petroleum residues and other floating pollutants are observed, this should be reported on the log form. To assess pollution, it is equally important to know when no pollutants have been observed. For surface platforms, a report is required at least once every 24 hours. For aerial observations, a description of the flight path is required.

1.3.   METHODS OF OBSERVATION

For usual observations no instruments are needed, although polarizing glasses may be useful in detecting oil slicks from ships. Oil slicks and other floating pollutants should be reported up to a distance of 1.5 nautical miles on either side of the observing ship. At greater distances pollutants and other sea features may be confused. Guidelines for the visual recognition of oil slicks from ships are given in section 3 below, and from aircraft, in section 4. Remote-sensing techniques (e.g., side-looking airborne radar (SLAR), and infra-red radiometers) may be used.

1.4.   EXPERIMENTAL PRODUCTS AND SERVICES

The centres designated to analyse the visual observations of floating materials should develop experimental products to show: (a) the areas polluted; (b) the intensity of the pollution; and (c) the temporal variation. These products will be reviewed by the National Co-ordinators and by the relevant subsidiary bodies of IOC, as appropriate.

1.5.   RECRUITMENT OF OBSERVERS

The procedures to be followed for the recruitment and training of observers and for liaison with ships will be provided to the National Co-ordinator in connection with the initiation of the activity.

2.   INSTRUCTIONS FOR COMPLETING THE FORM

(Code tables with explanations are given in Annex I; the relevant log form is contained in Annex II).

2.1.   OBSERVATIONS FROM FLOATING OR FIXES PLATFORMS
         (e.g. SHIPS, COASTAL STATIONS)

2.1.1.   Day and time should be reported in Greenwich Mean Time (GMT).

2.1.2.   The position of the observing platform should be reported in degrees and minutes of latitude and longitude; the appropriate quadrant of the globe should be entered in column Qc.

2.1.3.   Information on the status of the observation should be entered in column A on the following occasions:

- Whenever oil or other floating wastes are observed, enter 2 in column A. Information should be entered using the code tables provided in Annex I. Time and position should refer to the last point at which the pollutant was observed.

- If no pollutants were observed during the last 24 hours, enter 0 in column A. The position of the observing platform at local noon should be reported.

- If it has not been possible to observe the sea surface, owing to bad visibility, navigational difficulties or other reasons during the preceding 24 hours, enter 1 in column A. The position of the observing platform at local noon should be reported.

2.1.4. Observational details about the pollutant should be given in columns B, C, D (see code tables in Annex I).

2.1.5. The dimensions of the polluted area should be given in tenths of nautical miles; 2.8 n.m., for example, should be entered as 028; if an area is covered with many narrow patches or lines of oil, the dimensions of the total area should be reported and not the dimensions of the individual patches or lines. A simple, narrow slick with a width less than 0.1 n.m. should be reported as 000.

If the oil slick extends beyond 1.5 nautical miles on either side of the ship, enter "999" in the "across track" columns of the log form.

2.1.6. If possible, wind direction and speed should be reported.

2.1.7. If possible, wave period and height should be reported.

2.2.   AIRBONE PLATFORMS (e.g., AIRCRAFT, HELICOPTER) USING VISUAL AND REMOTE-SENSING METHODS

2.2.1. Day and time should be reported in GMT.

2.2.2. The position of the observing platform should be reported in degrees and minutes of latitude and longitude; the appropriate quadrant of the globe should be entered in column Q; the positions should be reported in sequential order along the flight path.

2.2.3. Information on the status of the observation should be entered in column A on the following occasions:

- At the start and finish of the flight, as well as at significant points of deviation, the time and position should be reported and "0" entered in the column for A if no pollutants were observed.

- Whenever oil or floating pollutants are observed, enter 2 in column A. Observational details should be entered using the code tables below. Time and position should refer to the last point at which the pollutant was observed.

- If it has not been possible to observe the sea surface for a significant portion of the flight, report the position of the end of this segment by entering 1 in the column for A, giving the dimensions of this segment in the appropriate column.

2.2.4. Observational details about the pollutant(s) should be given in the columns B, C and D (see code tables).

2.2.5. Dimensions should be given as the length and the width of the polluted area. This may not necessarily be along and across the flight track, especially not when remote-sensing methods are used and the dimensions can be measured from displays or recordings. The dimensions should be given in tenths of nautical miles; 2.8 n.m., for example, should be entered as 028; if an area is covered with many narrow patches or lines of oil, the dimensions of the total area should be reported and not the dimensions of the individual patches or lines. A simple, narrow slick with a width less than 0.1 n.m. should be reported as 000.

2.2.6. If possible, wind direction and speed should be reported.

3. DISTINGUISHING BETWEEN OIL SLICKS AND NATURAL FILMS

3.1. LARGE SPILLS OF CRUDE OIL OR A RESIDUAL FUEL

Large oil spills are obvious to the eye. If the oil has not weathered to tar-like residues, there will be central zones which are brown or black in colour and represent thick oil layers. These will be surrounded by thinner films sometimes showing iridescence or sheen (variously coloured bands due to light interference effects). At the outer edges of the petroleum slick even thinner films may be present with no obvious colours, but which are visible because of their damping action on the capillary ripples. Subsequent weathering of these heavy petroleum products will lead to tar residues within the oil slick, usually at the downwind end.

3.2. DESCRIPTION OF DIFFERENT SURFACE FILMS

It is difficult to distinguish from natural sea slicks the films formed by some types of petroleum products. Such problems may arise when the spilled oil is a distillate product (diesel oil, lubricating fluid or fuel oil) which has spread into a thin film with little colour. Since an oil film of this type eliminates capillary ripples, as does a natural sea slick, the following guides should help the observer to make a correct distinction between petroleum oils and natural films.

3.2.1. When windspeeds are greater than 8 knots (4.1 m/sec), natural slicks are readily dispersed by air-sea dynamic forces. Under these conditions visible natural surface slicks will be rare, and visible films should be assumed to be oil pollution. However, a long, narrow, isolated band of slick, sometimes containing seaweed and ship's refuse, should not be considered an oil slick.

3.2.2. Under relatively calm wind conditions a considerable percentage of the sea surface can become covered with a natural surface film, shown by extensive areas of ripple-damped water. Pollutant slicks may be confused with natural films under such low-wind conditions.

A natural slick can be described as a visible sea-surface pattern in which capillary ripples are absent. It is a film of recent biologically produced organic material, generally too thin to be seen except by its ability to damp and to resist the formation of wind-generated ripples. The ripple-damping property produces a light reflection pattern which makes the slick visibly different from the surrounding rippled water. The slick is usually lighter in appearance than the rippled water, but may be seen as a darker zone when viewed toward the sun. In the absence of wind (no ripples) the entire sea surface appears to be slicked; however, there is generally no evidence of film colour, oily odour or of thick films unless pollutant oils are present.

3.2.3. The following rules of judgement would be applied in such a case: If the conditions in section 3.1 are observed (layers of dark oil and/or tar residues) or if an oily odour is evident, the slick should be considered of petroleum origin. When the sea is relatively calm and if the slick is not obviously petroleum, it should be considered to be a natural film and not recorded. When it is not possible to distinguish between a natural slick and an oil slick, the quantity of pollutant oil would be extremely small and the slick should not be recorded as a spill.

4.   IDENTIFICATION OF OIL SLICKS FROM VISUAL AIRBORNE OBSERVATIONS

In general, airborne observers of oil slicks may follow the guidelines in section 3 ("Distinguishing between oil slicks and natural films"). However, it should be stressed that the identification of oil on the sea is less difficult from an airborne platform than from a ship, because the observer has a greater perspective of the sea surface and a greater ability to distinguish contrasts in colour, shade and sea-surface texture. Usually, the entire oil slick can be seen from the air, and the oil is sometimes obvious because of its extent, shape and colour. However, oil on the water can be confused with natural slicks or zones of calm, especially at very low observational altitudes. The most reliable identifications of oil are obtained between altitudes of 150 and 800 m.

4.1.   SIGHTING OF OIL SLICKS

The visibility of oil on the relatively dark ocean depends not only upon the colour of the oil, but also on: (a) its effects on ripples, waves, and breaking water; (b) the angle (slant angle) of view; and (c) the relative positions of the slick, the viewer and the sun. Oil is most easily seen when the observer is between the sun and the slick. Oil slicks are often difficult to observe when they are between the observer and the sun. Under overcast skies the position of the slick relative to the observer and the sun is not so important. Oil slicks are less visible when viewed in the direction of oncoming wind-driven waves because the greater surface structure of the wave front masks the colour difference between the oil and the sea. Oil is more easily observed when viewed in the same direction as that of the travelling wave.

4.1.1.   Rough sea conditions

Oil slicks are evident from the air, because of their influence on small waves which in turn alter light reflectance. In an oil-covered area there is less chop (short abrupt wave motion) and sometimes fewer breaking waves and white caps than in the surrounding water. Dark oils, such as crudes and heavy fuel oils, are also detected by their colour on the sea and are not easily confused with other sea-surface effects. Light-coloured distillate oils (No. 2 fuel oil, diesel fuel, lubrication oil, etc.) spread into thin films more rapidly than the heavier oils. Such films will not necessarily be dark in colour, but because of wave damping may appear as either a light, dark or silvery patch depending upon the angle of view with respect to the sun. Heavier accumulations of oil may appear at the downwind end of the slick as a dark zone. When the seas are rough and show white caps, natural slicks are not apparent, and any observed slicks should be considered to be oil.

4.1.2. Calm Seas

When large areas of the sea are patchy in appearance as a result of relatively calm conditions due to the presence of natural slicks, great care is required in differentiating between oil and other observed surface features. Sea-surface features should be attributed to oil if they are dark silver in appearance, or show bands of iridescence.

4.1.3. Additional precautions

Under all sea conditions care should be taken to avoid the identification of water colour differences or cloud shadows as oil. In addition, oil discharged from a moving ship may take the shape of the ship's wake for a period of time. Such a wake should be considered oily only if it is dark in colour or if it persists for a greater distance behind the ship than would normally be expected.
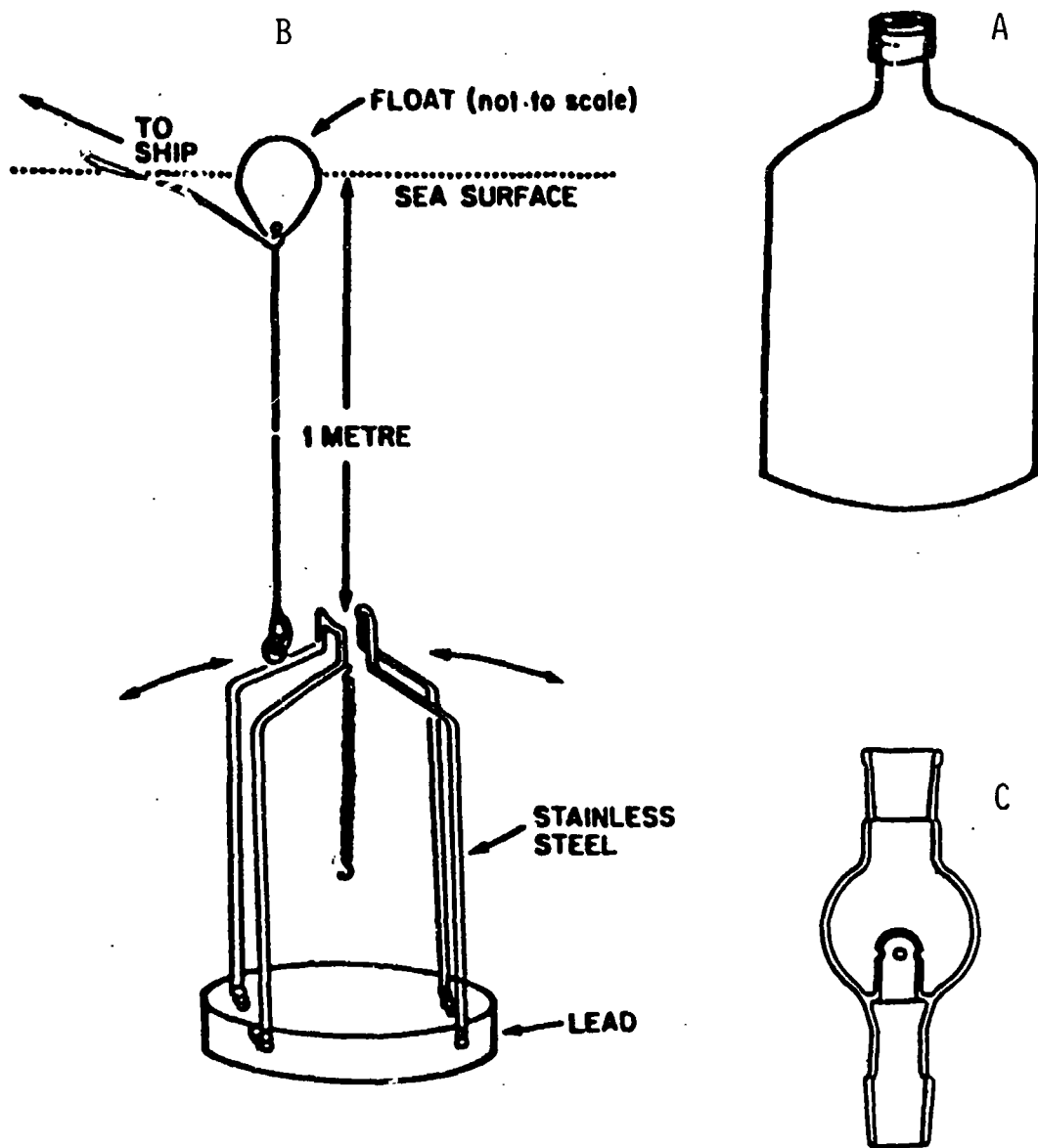
Figure 1 : A,B : Design of a simple device for water sampling
(A : sample bottle with cap,
B : bottle holder with floatation unit)

C : Solvent trap proposed to be inserted between sample flask and rotary evaporator.
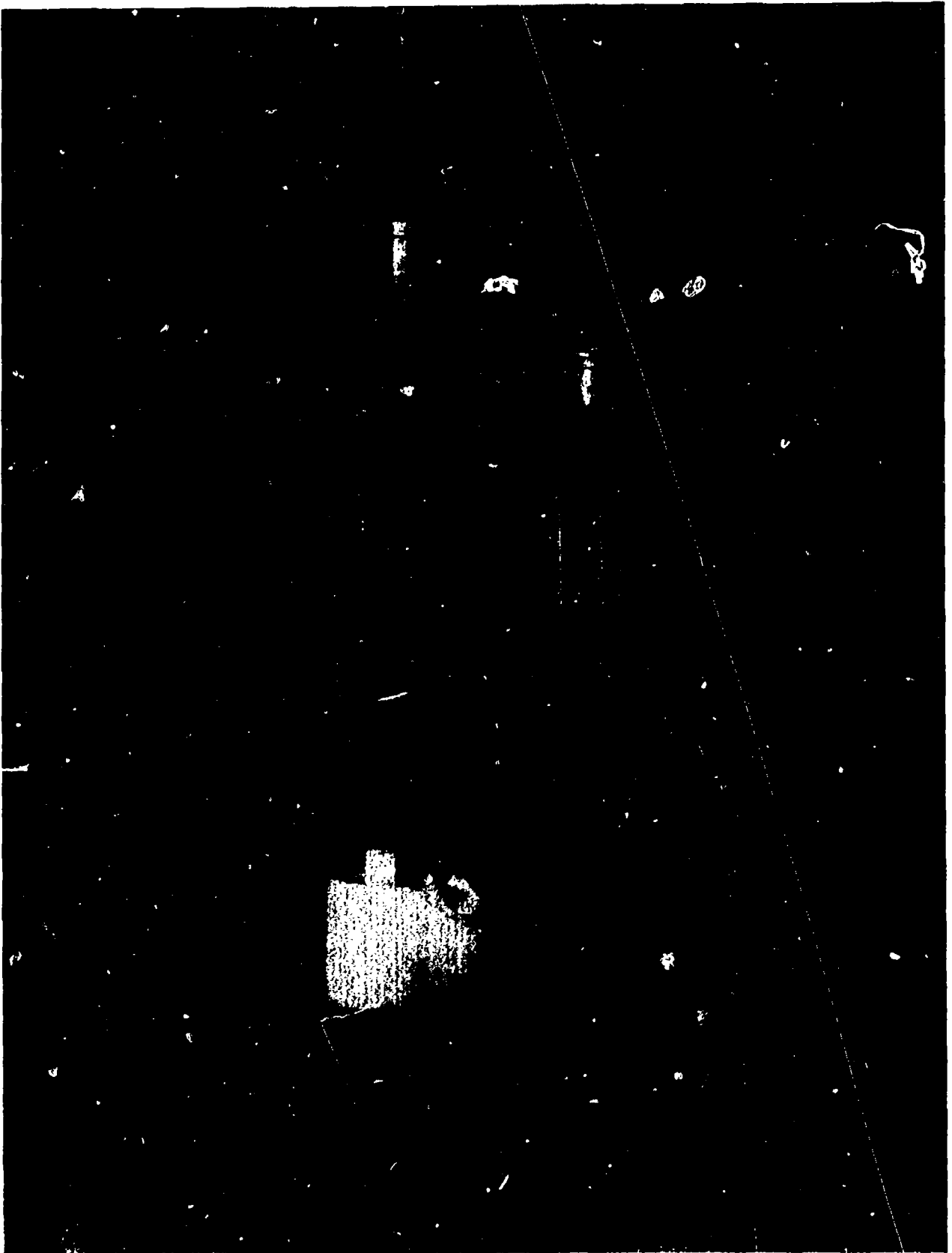
Figure 2 : Separatory funnel applied to sample bottle

<u>ANNEX I</u>

<u>CODE TABLES WITH EXPLANATIONS</u>

1. <u>OBSERVATIONAL CODE</u>
   This code is to be used for the information to be entered
   in the columns marked A, B, C, D on the log form for
   "Observation and Reporting of Oil Slicks and other Floating
   Pollutants".

(i) Status of observation

O = Sea surface observed but no pollutants to report
1 = Sea surface not observed, owing to high sea, bad visibility,
     or for other reasons
2 = Pollutants observed and recorded

(ii) Types of pollutants

1 = Thin oil film (may include occasional minor patches or
     lumps of thick oil)

2 = Thick oil layer (may be surrounded by oil film which should
     be included under this same code)

3 = Plastic materials
4 = Other (specify in remarks column)

(iii) Configuration

1 = Continuous cover
2 = Patches
3 = In a line or lines
4 = Patches and lines

(iv) Concentration

The concentration should be reported in eighths as, for example
the WMO code for ice coverage:

1 = 1/8   (slightest presence of reported pollutants
2 = 2/8
3 = 3/8
4 = 4/8
5 = 5/8
6 = 6/8
7 = 7/8
8 = 8/8 (continuous cover)

2. TYPE OF PLATFORM/SHIP

Code

	Type of Platform	Visual	Remote
1	Ship	11	12
2	Lightship	21	22
3	Buoy	31	32
4	Fixed Tower	41	42
5	Submersible	51	52
6	Aircraft	61	62
7	Ice Island	71	72
8	Fixed Coastal Station	81	82
9	Other	91	92

3. QUADRANT OF GLOBE (Qc)

Code figure	Latitude	Longitude
1	North	East
3	South	East
5	South	West
7	North	West

$Qc = 7$ N $Qc = 1$

W   ·   E

$Qc = 5$ S $Qc = 3$

NOTE: The choice is left to the observer in the following cases:

When the ship is on the Greenwich meridian or the 180th meridian ($LoLoLo = 000$ or 180 respectively):

$Qc = 1$ or 7 (northern hemisphere) or
$Qc = 3$ or 5 (southern hemisphere)

When the ship is on the Equator ($LaLaLa = 000$):

$Qc = 1$ or 3 (eastern longitude) or
$Qc = 5$ or 7 (western longitude)

4. WIND DIRECTION AND SPEED

(a) True wind direction (dd)

Enter the true wind direction, in tenths of degrees, from which the wind is blowing. Enter "00" for calm and "36" for a wind direction of 355 degrees to 004 degrees;

(b) True wind speed (ff) or force on the Beaufort scale

Enter "UNIT" with "m" for metres per second, with "k" for knots or with "B" for force on Beaufort scale. After having recorded the true wind speed in units indicated, prefix zeros to fill the field. Enter "00" for calm. When reporting on tar balls or on dissolved/dispersed hydrocarbons omit unit indicator and enter wind speed in metres per second;

5. **WAVE PERIOD AND HEIGHT**

(a) Wind wave period (PwPw)
Enter the average wind wave period to the nearest second.
Prefix zeros to fill the field. Enter "00" for calm and
"99" when the wind wave cannot be determined because the
sea is confused. When the wind wave period cannot be
determined for any other reason, enter two slashes (//).

(b) Wind wave height (HwHw)
Report wave height to the nearest half metre according
to the following WMO code:

```
 00  =  calm
 01  =  1/2   metre
 02  =  1     metre
 03  =  1 1/2 metre
 04  =  2     metres
05-99  =  Increases at 1/2 metre intervals
 //  =  Wave height not determined
```

6. **AIR TEMPERATURE** use only when reporting dissolved/dispersed
hydrocarbons

(a) Air temperature sign indicator (sn)
Enter "0" for positive temperatures and "1" for negative
temperatures (Celsius scale).

(b) Air temperature (TTT)
Enter the air temperature to tenths of a degree Celsius.
Prefix zeros to fill the field.

7. **WATER TEMPERATURE** use only when reporting tar balls or
when reporting dissolved/dispersed hydrocarbons

(a) Sea surface temperature (TwTwTw)
Enter the temperature to tenths of a degree Celsius.
To indicate negative temperatures, add 50.0 to the value
of the temperature measured and drop the negative sign.
For example, -1.2 degree Celsius would be encoded "512".
If a thermometer, as used, for example, in an engine-room
intake, is read only to the nearest whole degree Celsius,
this should be indicated in the tenths column by a slash (/).
Prefix zeros to fill the field.

ANNEX II

LOG FORMS

This Annex contains the data recording forms mentioned in the text:

- Data documentation form (Dissolved/dispersed petroleum hydrocarbons)

- Log for sampling, analysis and reporting dissolved/dispersed
  hydrocarbons

- Log for sampling and reporting particulate petroleum residues
  (tar balls)

- Log form for sampling and reporting tar on seashore

- Label of sample bottle for dissolved/dispersed petroleum
  hydrocarbons

- Log for observation and reporting of oil slicks and other
  floating pollutants.

Transmission of log forms:

Presently, two National Oceanographic Data Centres have undertaken to
serve as Responsible National Oceanographic Data Centres (RNODC) for
MARPOLMON-P, i.e. render certain services to the Programme, related to
data quality control, processing and storage.

Therefore, when a form is completed, it should be mailed to the address
provided by the National Co-ordinator in your country or to the
following RNODC's:

(a) for countries that are members of the IOC Programme Group for the
    Western Pacific (WESTPAC):

        Dr. T. Mori
        Director
        Japan Oceanographic Data Centre
        Hydrographic Department
        Maritime Safety Agency
        3-1, Tsukiji 5-chome
        Chuo-ku
        Tokyo 104
        Japan

(b) for other countries:

        Mr. E.L. Ridley
        Director
        National Oceanographic Data Centre
        National Oceanic and Atmospheric
            Administration
        2001 Wisconsin Avenue N.W.
        Washington, D.C. 20235
        U.S.A.

Please send a copy of the covering letter indicating time period, general area and amount of data, to

The Intergovernmental Oceanographic Commission (IOC)
Marine Pollution Research and Monitoring Unit
Unesco
Place de Fontenoy
75700 Paris
France

LOG FORM

FOR

SAMPLING AND REPORTING TAR ON SEASHORE

COUNTRY	INSTITUTE	RESPONSIBLE INDIVIDUAL	INDIVIDUAL RECORDING	DATE OF PREVIOUS SAMPLING

LOCATION			DATE	LOW TIDE (LOCAL TIDE)	TIME OF COLLECT (LOCAL TIME)	PREVAILING WIND DURING SAMPLING PERIOD		LENGTH OF SHOREFRONT (m)	DISTANCE FROM WATERLINE TO END OF SAMPLING (m) (3)	SEASHORE SURFACE (4)	WT OF TAR (g)	REMARKS
BEACH NAME	LAT DEG/ MIN	LONG DEG/ MIN				Direction[1]	Speed[2]					

(1) Average during period preceeding sampling
   (1) onshore
   (2) offshore
   (3) along shore

(2) Speed in m/sec
   (1) very weak
   (2) moderate
   (3) strong

(3) Horizontal distance inland between waterline and end of sampling

(4) Seashore surface
   (1) fine sand
   (2) coarse sand
   (3) pebbles
   (4) rock slabs

IOC MARINE POLLUTION MONITORING SYSTEM (MARPOLMON)

LOG FOR OBSERVATION AND REPORTING OF
OIL SLICKS AND OTHER FLOATING POLLUTANTS

OBSERVATION/PLAT-FORM HEIGHT ABOVE SEA LEVEL

_____ Meters

PLATFORM/SHIP					COUNTRY	INSTITUTE/ORGANIZATION
TYPE	NAME		FLAG	RADIO CALL		

DATE/TIME						LOCATION										POLLUTION DATA				COVERAGE (1/10 N. Miles)		ENVIRONMENTAL DATA								Temp.		REMARKS
G.M.T.						QUAD	LAT.		LONG.													WIND			WAVE						
DAY		MO.		YEAR		HR.	MIN.			DEG.	MIN.		DEG.		MIN.					ALONG TRACK	ACROSS TRACK	UNIT	DIR.		SPEED		PER.	HT.		Air	Water
Y	Y	M	M	J	J	G	G	g	g	Qc	La	Le	Lo	Le	Lo	Lo	Lo	Lo	Lo	A	B	C	D	TRACK	TRACK	UNIT	d	d	f	f	Pw	Pw	Hw	Hw			

PLATFORM/SHIP			IOC MARINE POLLUTION MONITORING SYSTEM (MARPOLMON)
TYPE	NAME *	CALL SIGN *	
			LOG FOR SAMPLING AND REPORTING PARTICULATE PETROLEUM RESIDUES (TAR BALLS)

COUNTRY	INSTITUTE	CRUISE NO. *	SAMPLING DEVICE	MESH SIZE

STATION NUMBER	SAMPLE NUMBER (1)	WIDTH OF NET (CM)	DISTANCE TOWED (N.M.)	TO BE FILLED BY LABORATORY		DATE * (GMT)			TIME * (GMT)			POSITION *					OPTIONAL ENVIRONMENTAL INFORMATION						
				WEIGHT OF TAR (g)	TAR CONC. (mg/m²)	DAY	MO.	YR.	HR.	MIN.		LAT.		LONG.		WIND		WAVE		TEMP. °C			
											Q	DEC.	MIN.	DEG.	MIN.	DIR.	SP.	PER	HT.	AIR		WATER	

29

IOC MARINE POLLUTION MONITORING SYSTEM (MARPOLMON)

LOG FOR SAMPLING, ANALYSIS AND REPORTING DISSOLVED/DISPERSED HYDROCARBONS

PLATFORM/SHIP

TYPE	NAME *	CALL SIGN *

COUNTRY	INSTITUTE	CRUISE NUMBER *

STATION NUMBER	SAMPLE * NUMBER	CONCEN- TRATION (2) μg/kg	DATE * (GMT)			TIME * (GMT)		QO88B	POSITION *				OPTIONAL ENVIRONMENTAL INFORMATION						REMARKS
			DAY	MO.	YR.	HR.	MIN.		LAT.		LONG.		WIND		WAVE		TEMP. °C		
									DEG. MIN.		DEG. MIN.		DIR. SP.		PER HT.		AIR	WATER	
			Y Y	M M	J J	G G	g g	Qc	La La	La La	Lo Lo	Lo Lo	iu dd	dd ff ff	Pw Pw	Hw Hw	*n Ta Ta Ta		Tw Tw Tw	

NAME AND ADDRESS (Individual/Office to contact reference this report.)

NOTE! — Include Items marked with an asterisk on bottle label.

(1) This form should be accompanied by the IOC (MARPOLMON-P) Data Documentation Form

(2) Concentration to be determined by Analysis Laboratory

PLATFORM/SHIP			IOC MARINE POLLUTION MONITORING SYSTEM (MARPOLMON)
TYPE	NAME	CALL SIGN	

IOC MARINE POLLUTION MONITORING SYSTEM (MARPOLMON)

DATA DOCUMENTATION FORM
(To be prepared by Analysis Laboratory; for use with IOC (MARPOLMON-P) Log for Sampling, Analysis, and Reporting Dissolved/Dispersed Hydrocarbons)

COUNTRY	INSTITUTE	CRUISE NUMBER	ANALYSIS LABORATORY

STATION NUMBER		SAMPLE NUMBER		(1) COLLECTION TECHNIQUE AND SAMPLING EQUIPMENT	(2) IDENTIFICATION AND STANDARDS	(3) ANALYTICAL METHODS AND IDENTIFICATION OF INSTRUMENTATION
FROM	TO	FROM	TO			

ADDITIONAL DOCUMENTATION

NOTE

TYPE OF SAMPLE BOTTLE	ESTIMATED ACCURACY OF METHOD
FIXING AGENTS	OTHER (Specify)
DURATION OF SAMPLE STORAGE	OPTIONAL: TAR BALL ANALYSIS ONLY
DATE(S) OF SAMPLE ANALYSIS	□ SAMPLE FROZEN □ REFRIGERATED □ AMBIENT □ FILTERED □ UNFILTERED
SAMPLE SPLIT	FILTER SPECIFICATIONS
EXTRACTION PROCEDURE	SAMPLE PURIFICATION

(1) e. g. plastic bucket, glass jar, ship's intake.

(2) The oil used to calibrate the instrumentation or method.

(3) Narrative description, with emphasis on differences (if any) from the techniques recommended

LABEL OF SAMPLE BOTTLE FOR DISSOLVED/DISPERSED PETROLEUM HYDROCARBONS

Label of sample bottle

Cruise _____ Platform/Ship (Name and Call Sign) _____

Date/Time (GMT) _____ Sample No _____

Lat _____

Long _____

Comments _____

ANNEX III

THE FUNCTIONS OF NATIONAL CO-ORDINATORS*

Each of the participating countries shall appoint officially a National Co-ordinator with the following terms of reference :

The Co-ordinator shall :

1. Act as liaison officer between all the participating laboratories and agencies of his country and the IOC Secretariat;

2. Identify institutions and other agencies in his country that might participate in the programme and inform the Secretary IOC thereof;

3. Issue from time to time clear guidance and instructions on the programme procedures and practices to the participating laboratories in their national language, if possible;

4. Ensure regular collection and submission of data to the relevant national data centre or, where such centres do not exist, be responsible for submitting the data to the appointed Responsible National Oceanographic Data Centre (RNODC);

5. Be responsible for dissemination of information from the IOC Secretariat or the data centres to the project leaders of the participating national laboratories and other national bodies;

6. Submit, on request, a brief report to the Secretary IOC on progress achieved.

    * The functions of the National Co-ordinators have been approved by the Working Committee for GIPME.

ANNEX IV

RELEVANT LITERATURE

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