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**IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP
JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS
OF MARINE POLLUTION
- GESAMP -**

REPORTS AND STUDIES

No.10

REPORT OF THE ELEVENTH SESSION

Dubrovnik, Yugoslavia, 25-29 February 1980



United Nations Environment Programme

IMCO/FAO/UNESCO/WMO/WHO/IACA/IN/UNEP Joint Group of Experts
on the Scientific Aspects of Marine Pollution (GESAMP)

REPORT OF THE ELEVENTH SESSION
Dubrovnik, Yugoslavia, 25-29 February 1980

UNEP, 1980

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Notes

1. GESAMP is an advisory body consisting of specialized experts nominated by the Sponsoring Agencies (IMCO, FAO, UNESCO, WMO, WHO, IAEA, UN, UNEP). Its principal task is to provide scientific advice on marine pollution problems to the Sponsoring Agencies and to the Intergovernmental Oceanographic Commission (IOC).
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* * *

Definition of Marine Pollution by GESAMP

"POLLUTION MEANS THE INTRODUCTION BY MAN, DIRECTLY OR INDIRECTLY, OF SUBSTANCES OR ENERGY INTO THE MARINE ENVIRONMENT (INCLUDING ESTUARIES) RESULTING IN SUCH DELETERIOUS EFFECTS AS HARM TO LIVING RESOURCES, HAZARDS TO HUMAN HEALTH, HINDRANCE TO MARINE ACTIVITIES INCLUDING FISHING, IMPAIRMENT OF QUALITY FOR USE OF SEA WATER AND REDUCTION OF AMENITIES."

* * *

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SUMMARY OF THE REPORT OF THE WORKING GROUP ON SCIENTIFIC ASPECTS OF
THE REMOVAL OF HARMFUL SUBSTANCES

Information contained in this report was compiled originally in 1972 during the IVth Session of the Group of Experts on the Scientific Aspects of Marine Pollution. The Working Group, formed at the GESAMP X, was to update, revise and complete the document prepared at GESAMP IV. Additional information has been gathered during an intersessional period and the report expanded to meet criticisms of the original report. The report reviews methods of treatment and disposal, the relation of treatment and disposal practices to the effects of pollutants, evaluates methods available to treat or dispose of twelve general categories of waste, and provides a limited bibliography on the subject. The methods of treatment and disposal have been reviewed in four general categories, including:

- (i) solids/liquid separation;
- (ii) biological treatment methods;
- (iii) sludge handling and disposal; and
- (iv) specific residual harmful substance removal.

The harmful substances in question were those twelve categories defined by GESAMP during its IIIrd session and include domestic sewage, pesticides, inorganic wastes, radioactive materials, oil and oil dispersants, petro-chemicals and organic chemicals, organic wastes, military wastes, heat, detergents, solid objects, and dredge spoil and inert wastes. The report includes flow diagrams and schematic representations of treatment methodology along with associated costs and efficiencies which may be expected. Guidance is offered pertaining to the usefulness of various methodologies as they may be employed to control the discharge of harmful substances, to reduce such pollution threats as harm to living resources, hazards to human health, hindrance to marine activities, and reduction of amenities.

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at the present time may not modify the interfacial exchange of matter or energy significantly on a global scale, but that in certain coastal zones and seas, especially along shipping routes, such films will be more prevalent and could modify interfacial properties and exchange processes.

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SUMMARY OF THE REPORT OF THE WORKING GROUP ON THE INTERCHANGE OF
POLLUTANTS BETWEEN THE ATMOSPHERE AND THE OCEANS

The report is actually the result of the two sessions of this Working Group, the first held in Dubrovnik in October 1977 and the second at the Pacific Environment Institute, West Vancouver, B.C., Canada from 18 to 22 September 1978.

The Working Group made assessments of fluxes of selected pollutants between the atmosphere and the oceans based on the best available data, reviewed the mechanisms governing pollutant interchange, identified the modes of transport between air and sea for each pollutant, examined the effects of pollutants on chemical and physical air-sea interfacial processes and reviewed the surface-chemical aspects of pollutant interchange. Pollutants which are modified by photochemical reactions and undergo gas-particle interchange in the lower troposphere were tabulated. Consideration was given to biological involvements in pollutant interchange and to the transmission of micro-organisms from the sea to the atmosphere. Guidelines were developed for a measurement programme for the determination of air-sea fluxes.

The most significant transport modes from air to sea were identified for the selected pollutants as follows: the heavy metals, sulphate, radionuclides and micro-organisms move seaward as either dry fall-out or as a result of precipitation processes; gases which react with or are soluble in water are transported by precipitation as well as by gas-phase transport processes (e.g. SO_2); while liquid-phase transfer is the principal mode of transport for gases which do not react with or dissolve extensively in water (gaseous hydrocarbons and halogenated hydrocarbons). High-molecular-weight hydrocarbons and halogenated hydrocarbons exist as both gases and particles in the atmosphere and are transported to the sea by all three modes. The net open-ocean transfer for all the selected pollutants, on which enough information was available to make a judgement, was from the atmosphere to the ocean. In the case of petroleum in sea-water, the lighter, more volatile constituents move from sea to air, while the heavier, possibly photochemically reactive components follow the opposite path.

Processes which modify pollutants in the lower troposphere include gas-particle interconversion, photochemical reaction and heterogeneous reactions with water drops. Petroleum hydrocarbons, Hg, As and SO_2 are modified by both processes, while CO_2 , Pu, Am, Cu, Ni, Cr and V are not significantly altered in the lower troposphere. Heavy halogenated hydrocarbons undergo gas-particle exchange, but the group did not have expertise to determine whether photochemical reactions occur with these pollutants. Fluorochlorocarbons do not undergo significant photochemical reaction in the lower troposphere, and there is uncertainty about the importance of their gas-particle interactions.

The air-sea interface and interfacial exchange processes may be altered by detergents, petroleum and its derivatives, and the complex mix of surface-active components from municipal wastes and sewage sludge. Petroleum is the most widespread open-ocean pollutant affecting the properties of the sea surface. Continuous surface films of petroleum oils are recognized to produce significant effects at the air-sea interface. Such films arise primarily from oil spills and overboard discharges from ships, although natural seeps and offshore petroleum production produce surface films of oils in specific locations. Recently data collected by the IOC/WHO/IGOSS Marine Pollution (Petroleum) Monitoring Project (MAMP/PPP) have been processed and partially analyzed. On the basis of these preliminary analyses, the Working Group concluded that petroleum films as observed

1. OPENING OF THE MEETING

The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) held its eleventh session at the Inter-University Centre for Postgraduate Studies, Dubrovnik, Yugoslavia, from 25 - 29 February 1980 under the Chairmanship of Mr. V. Pravdic. Mr. A. McIntyre was Vice-Chairman.

- 1.2 The session was opened by the UNEP Technical Secretary who welcomed the participants on behalf of the Executive Director of UNEP. Representatives of the national authorities, the city of Dubrovnik and its scientific community attending the opening ceremony greeted the participants and expressed their satisfaction with the fact that the first session of GESAMP convened outside the headquarters of the sponsoring organization was convened in Yugoslavia. The Administrative Secretary of GESAMP gave thanks on behalf of participants for the good wishes for the success of the session and for the efforts made in organizing it in Dubrovnik, in particular the efforts of the Chairman of GESAMP.
- 1.3 The agenda for the session as adopted by the Group is given in annex I. A list of documents submitted to the session, including information papers relating to the activities of the sponsoring organizations and substantive papers relating to particular items of the agenda, is given in annex II.
- 1.4 A list of participants is given as annex III. The Group noted with regret that several members of the Group were unable to attend the session.

2. MARINE POLLUTION IMPLICATIONS OF COASTAL AREA DEVELOPMENT

- 2.1 The absence of the Working Group Chairman, Mr. H. A. Cole, was noted with regret by the Group which expressed its appreciation for the considerable contribution he has made not only to the current report but to the work of GESAMP since its inception.
- 2.2 The report was introduced by Mr. G. Kullenberg who characterized it as a final report (GESAMP XI/5) which should be considered for approval and publication. The document was the result of three intersessional meetings, the first having been held at IMCO Headquarters in London from 10 to 14 January 1977, the second at the Institute of Marine Affairs, Trinidad and Tobago, from 16 to 20 January 1978 and the third at FAO Headquarters in Rome from 30 April to 4 May 1979. A summary of the report is given in annex IV.
- 2.3 The terms of reference of the Working Group as given at the eighth session of GESAMP were reviewed. The principal task was to "formulate guidelines for the assessment of the marine pollution implications of specific coastal area developments, particularly for the purpose of providing assistance to developing countries".
- 2.4 It was noted that the interim report presented at the tenth session of GESAMP had received thorough editing and streamlining incorporating the comments and suggestions made by the Group. In addition, an aspect that had not in the past been considered in sufficient detail, human health, had received more attention in the intersessional period.
- 2.5 The Group noted the breadth of the study and made several comments on specific items which were incorporated in the report. The few selected examples contained in the report were discussed and it was noted that they reflected the experience of the Working Group's members.

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- 2.6 It was recalled by the Group that the report was intended mainly for coastal area planners dealing with coastal areas that had not yet been highly developed.
- 2.7 The Group requested that additional explanatory notes be added to matrices because readers might refer to these matrices without sufficient scrutiny of the text. Supplementary statements which were prepared during the session were examined and accepted by the Group.
- 2.8 The Group agreed that the Working Group had completed its task and expressed its thanks to its Chairman and members. The Group approved the amended report (table of contents given in annex IV) for publication in the GESAMP Reports and Studies.
3. MONITORING OF BIOLOGICAL VARIABLES RELATED TO MARINE POLLUTION
- 3.1 The Chairman of the Working Group introduced the final report (GESAMP XI/B). A summary of the report is given in annex V.
- 3.2 The Group noted an apparent absence in the report of citations from the open scientific literature, but it was pointed out that the documents referred to in the report themselves contained a vast number of such references. The Group approved the report (table of contents given in annex V) on the understanding that the Chairman of the Working Group would make certain editorial improvements prior to the report's publication in GESAMP Reports and Studies.
4. REVIEW OF THE HEALTH OF THE OCEANS
- 4.1 The Chairman of the Working Group on a Review of the Health of the Oceans reviewed the summary report of the first session held in Copenhagen, 5-11 July 1979, and the summary report of a meeting of a core group of the Working Group, held in Dubrovnik, 22-23 February 1980. The latter assessed the work done so far by the four task groups, which had been somewhat delayed by the unexpected postponement of GESAMP XI from September 1979 to February 1980, since there had been a general reluctance to proceed pending acceptance by GESAMP of the approach adopted by the Working Group. The core group meeting made practical recommendations on the advancement of the work, the structure of the report, including names of contributors, the timetable of meetings required, and the revision of the Working Group's composition. A summary of the report of the Working Group's meetings mentioned above is given in annex VI.
- 4.2 The Group recognized that the schedule of work and meetings was extremely tight but that this was unavoidable because of the need for the completion of the work by the end of 1981. The current timetable scarcely allowed time for the resolution of divergent viewpoints on key subjects within the Working Group. The Working Group would only be able to define the problems; solutions to them would have to be taken up later, beyond the currently agreed timetable.
- 4.3 Sewage was mentioned as one category of pollutant which was of global concern, and it was therefore stressed that the Working Group should consider the role of sewage in the health of the oceans.
- 4.4 The Group noted with approval the new approaches to the subject which were

definition of the hazard rating symbol "0" should be reconsidered with a view to amending that symbol as follows:

"0 refers to a substance for which the evidence does not support a rating of +, I, Z or B".

After careful consideration of that suggestion the Working Group had concluded that it could not accept the proposal and that it preferred to use in future the earlier definition of that symbol indicating a substance for which there was no evidence to support one of the ratings +, I or Z.

In the course of reviewing the definition of symbols of criteria of ratings connected with the potential bioaccumulation of substances, the Working Group also agreed that the symbol "B", which was meant to indicate that the substance in question was bioaccumulated but that the hazard to aquatic life or man was not known, should in future not be used but that a "-" rating would be more appropriate, indicating inadequate information.

The Working Group felt that the time had come when it seemed necessary to produce a report which would revise and update with clarification, the original Hazard Profile Rationale document (GESAMP IV/19 Supp.1) and would include all the appropriate sections and annexes of the individual reports.

In the light of the amount of work involved it was proposed that in addition to the usual once per year meeting, which would be devoted mainly to developing new hazard profiles, a special meeting of the Working Group should be held in mid-December 1980, with a view to the preparation of the draft document for approval by GESAMP and subsequent publication.

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being incorporated in the Working Group's proposal. It also stressed the importance of separating the scientific aspects of the study from the possible uses made of the report by policy makers.

4.5 The Chairman noted that this was by far the biggest job undertaken by GESAMP, that it must draw on much of the previous work of GESAMP, and that in spite of time constraint in the preparation of the first report the science involved should not be compromised.

4.6 The Group approved the schedule of the work and called on the Working Group to proceed as rapidly as possible with the work it had set itself, and decided to consider the report at its next session (October 1981) with a view to its approval and to its publication in GESAMP Reports and Studies.

4.7 The UNESCO (lead agency) Technical Secretary reminded the Group of the importance of the expected results of the Working Group to the IOC's programme entitled "Global Investigation of Pollution in the Marine Environment".

5. OCEANOGRAPHIC MODEL FOR THE DISPERSION OF WASTE DISPOSED OF IN DEEP SEA

5.1 The Group was informed of the request made by the IAEA to GESAMP through the Chairman of the Group on scientific advice, as follows:

"to recommend to the agency the most appropriate oceanographic model for predicting the dispersion of pollutants from the deep ocean as a result of their being dumped there in a container that remains intact until it reaches the bottom and advice on the methodology for calculating the resultant water concentrations of the pollutant throughout an ocean basin."

5.2 In presenting the item, the IAEA Technical Secretary explained the mandate of the IAEA for the continuing review and future revision of the Revised IAEA Definition and Recommendations of 1978 Concerning Radioactive Wastes and Other Radioactive Matter Referred to in annexes I and II to the London Dumping Convention (INFCIRC/205/Ann.1/Rev.1), which would involve the following:

- a) Oceanographic dispersion models;
- b) Radiological assessment model;
- c) Review of the resulting Definition and Recommendations.

Advice was sought from GESAMP that related to the task mentioned in a) above, while b) and c) would be carried out by IAEA.

5.3 The IAEA Technical Secretary further presented to the Group background material, which included:

- The text of the IAEA Revised Definition and Recommendations of 1978 mentioned above (INFCIRC/205/Ann.1/Rev.1);
- Comparisons between the Provisional Definition and Recommendations (accepted by the First Consultative Meeting of Contracting Parties to the London Dumping Convention in 1976) and the Revised Definition and Recommendations (accepted by the Fourth Consultative Meeting in 1979);
- Outline of Shepherd model used for the Revised Definition and Recommendations;

SUMMARY OF THE REPORTS OF THE WORKING GROUP ON EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS

- Lists of oceanographers associated with the Revised IAEA Definition;
- Tentative schedule of meetings of the proposed Working Group.

- 5.4 In response to the questions raised by some experts as to why IAEA could not use its own advisory or consultancy mechanism, the IAEA Technical Secretary explained that IAEA currently felt the need to draw on broader oceanographic expertise in order to help refine IAEA's model, and considered that GESAMP would be an appropriate body in which such expertise would be available. He added that the proposed course of action had been accepted and encouraged by the Fourth Consultative Meeting.
- 5.5 Some experts were of the opinion that the development of a new physical oceanographic model would involve new research work and therefore might not be appropriate for GESAMP. There was, however, agreement that improvements in the physical oceanographic modelling would be feasible, although it would be extremely difficult and a long-term task to develop a single comprehensive model that would encompass the biological, geochemical and physical processes and cover very different initial and boundary conditions.
- 5.6 It was suggested that a more realistic approach would be to calculate water column concentrations of radionuclides stemming from an initial radioactive source on the bottom of the deep oceans using the current knowledge of the pertinent oceanographic dispersal processes. It was also noted that the development and use of a model would not only involve research work but might also provide unwarranted generalizations that would not be applicable in all situations.
- 5.7 In the light of the above discussions, the Group agreed to undertake the task requested by the IAEA and to establish a working group on an oceanic dispersion model, with the following terms of reference:
- a) to advise on the present knowledge of pathways by which substances might be transferred from a deep ocean (deeper than 4 kilometres) dumping area to man;
 - b) where possible, to recommend methods for calculating the concentration of substances, arising from containers deposited on the deep ocean floor, in the water column throughout an ocean basin;
 - c) to assess the reliability of the calculated concentrations.
- 5.8 The IMCO, UNESCO and UNEP Technical Secretaries expressed interest in the subject and indicated the willingness of their organizations to co-operate with the work of the Working Group.
- 5.9 The Group appointed Mr. G. Needler as the Chairman of the Working Group on the understanding that he would become a member of GESAMP. The Working Group would include Mr. G. Kullienberg as well as other experts within and outside GESAMP to be nominated by IAEA in consultation with the Working Group Chairman and co-operating organizations. The first meeting of the Working Group was planned for 8-12 December 1980 in Vienna, Austria.
6. BIOLOGICAL EFFECTS OF THERMAL DISCHARGES IN THE MARINE ENVIRONMENT
- 6.1 The FAO Technical Secretary introduced agenda item 6. He recalled that at its

The Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships had held its eighth session in Bergen, Norway, from 22 to 26 May 1978 under the Chairmanship of P. G. Jeffery and its ninth session in Burnham-on-Crouch, United Kingdom, from 5 to 9 November 1979 under the Chairmanship of J. E. Portmann.

The Working Group had at both sessions continued with the evaluation of hazards of substances for which IMCO's Sub-Committees on Bulk Chemicals and on the Carriage of Dangerous Goods had requested consideration. The Working Group also developed hazard profiles for substances on which data had been submitted by several Governments to GESAMP through IMCO. The Group had received a number of existing hazard profiles both for individual substances and groups of substances in the light of new information which had been made available to the Working Group from several outside sources as well as by individual members of the Working Group from their own research work.

The Working Group had considered a suggestion that a detailed theoretical study should be conducted of the oxygen demand of a number of substances under a variety of situations. The Working Group concluded, however, that there was adequate practical experience to show that that was not a problem related to operational or accidental discharges from ships.

The Working Group had carefully considered the problems of evaluating substances for which there was evidence of persistence or bioaccumulation (even of short duration). They also considered how to identify those substances for which there was substantial evidence of irreversible long-term and/or chronic injury such as carcinogenesis or mutagenesis in mammals.

In tackling the question, the Working Group had considered the entire Composite List of Hazard Profiles of Substances Carried by Ships (BCH/Circ.8). The Working Group identified from that list on the basis of intersessional work carried out by one of its members, that there appeared to be a need to recognize a potential rate of carcinogenic activity under the circumstances of discharges consequent upon ship-borne transport. In reaching a consensus view on that topic the Working Group agreed that compounds which had been demonstrated to be carcinogenic at high doses in laboratory mammals were not likely to persist on beaches for repeated exposure in the event of a large spill; those were therefore only identified as "carcinogens" in the "remarks" column of the profiles. Compounds that were established "human carcinogens", or which produced malignant tumours in animals through systematic action and which were of a chemical nature to suggest potential reactivity with cellular genetic material, were judged by the Working Group to have serious potential for carcinogenic hazard to man. In those cases the Working Group rated the compounds as II (hazardous) in Column D (Hazard to human health, skin contact and inhalation) and as "human carcinogen" or "carcinogen" (when only animal data were available) in the "remarks" column.

The Working Group, in the course of producing hazard profiles, expressed concern at the rather vague names which some substances appeared to be carried under. It was agreed that substances like acrylic ester would be rated on the basis of the worst rated substance of the different compounds said to be carried under that name.

The Working Group noted that at its tenth session GESAMP had suggested that the

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- eight session, GESAMP had established a Working Group on Biological Effects of Thermal Discharges in the Marine Environment, which had met only once for one day immediately prior to the ninth session of GESAMP. The tenth session had subsequently reviewed the situation of the Working Group and concluded that it should be held in suspense until more information was available to allow GESAMP to make a judgement on the importance of the problems of thermal discharges. To that end, FAO presented a paper prepared by Ms. A. Thorhaug.
- 6.2 The Chairman of the Working Group introduced the paper by Ms. A. Thorhaug (GESAMP XI/7) and drew special attention to the need for GESAMP to act as a liaison between science and management, deriving from available scientific information guidelines that could be directly of use to managers and decision makers in the siting of power plants. He also referred to UNESCO Technical Papers in Hydrology No. 20, entitled "Predicting Effects of Power Plant Once-through Cooling on Aquatic Systems".
- 6.3 The Group felt that enough information was now available for the Working Group to determine whether thermal discharges do pose a threat to living marine resources and requested the Working Group to advise, if appropriate, on what has to be done to minimize adverse effects on marine life, resulting from thermal discharges. Since several impact assessment studies of thermal releases in temperate zones were already available, it was agreed that the Working Group should pay special attention to tropical and subtropical environments, thus responding to the needs of many developing countries.
- 6.4 It was suggested that the Working Group should not only deal with the direct effect of thermal discharges, namely the increase in temperature, but also with possible indirect effects, including alterations in the metabolism and bioaccumulation of toxic substances. Additionally, it was noted that power plant effluents had effects other than those caused by temperature; e.g., those due to chlorination. Other suggestions made were also to list possible positive effects or benefits such as the use of heated water in aquaculture, and in that connection to pay attention to alternative techniques such as utilizing cool, nutrient-rich deep water for cooling purposes, which is subsequently released at ambient temperatures.
- 6.5 The Group noted that siting of power plants was closely related to general problems of coastal area development planning. Since it was felt to be inappropriate to continue the Working Group of Coastal Area Development, a proposal was made to establish a new working group to deal with marine pollution implications of ocean related energy development, which could incorporate in its terms of reference the evaluation of effects of thermal discharges on the marine environment. The Group, however, recognized the advantage of keeping terms of reference of working groups as simple and concise as possible, and therefore it decided to maintain the Working Group on Biological Effects of Thermal Discharges in the Marine Environment and to defer consideration of the establishment of the proposed new working group to agenda item 12, Future Work Programme.
- 6.6 It was finally decided to reactivate the Working Group on Biological Effects of Thermal Discharges in the Marine Environment and to change its terms of reference slightly so as to read:

- To selectively review available information on the effects of thermal discharges on coastal waters, and subsequently evaluate direct and indirect adverse effects of thermal discharges on marine life, particularly fishery resources;

- To develop guidelines for the siting of discharges of heated water, with a view to minimizing harmful effects on living marine resources.

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6.7 The Group considered that the Working Group should pay particular attention to the direct and indirect effects of thermal effluents but that their report should also mention the other possible effects of power plant effluents.

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6.8 It was understood that the Working Group should consist initially of four to five experts to deal with the first term of reference only, and that it would report to GESAMP XII which might eventually decide to broaden its expertise to enable it also to tackle its proposed second task. Mr. V. Pravoic agreed to continue to chair the Working Group. FAO would continue as lead agency with UNEP joining as co-sponsor. The UNESCO Technical Secretary indicated that his organization was interested in supporting the Working Group.

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7. EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS

Task Group on Geographical Areas

7.1 The IMCO Technical Secretary informed the Group that the Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships had held one meeting since the tenth session of GESAMP but reminded the Group that it still had to approve formally the report of a meeting held shortly before its tenth session in Paris. Accordingly, the reports for the Working Group's eighth session in Bergen, Norway (22-26 May 1978) and its ninth session in Burnham-on-Crouch, England (5-9 November 1979) were introduced by the Chairman of the Working Group. A summary of these reports is given in annex VII.

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7.2 The Group noted in particular that, for the time being, the Working Group was proposing to drop the use of the symbol BOD, pending the conduct of a review of the way in which BOD could be quantified. It was, however, noted that BOD is referred to in category D substances as defined by appendix 1 of the IMCO MARPOL Convention. The Group accepted the reasoning behind that decision but requested that in order to explain it better an addition should be made to the report.

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7.3 The Group also noted that the Working Group had concluded that the proposal GESAMP had made at its tenth session for the definition of the "O" symbol for bioaccumulation did not correctly describe the use of the term made by the Working Group. The Group recognized that the distinction, although a small one, was important and for practical reasons accepted the position of the Working Group.

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7.4 In addition to the examination of the definition of the "O" symbol, the Working Group had attempted to clarify and illustrate the definition of all the bioaccumulation symbols. In the course of their deliberations it had been decided that the use of the "B" symbol should be eliminated. That symbol had been introduced at the seventh meeting and did not fit into the original rationale or the use made of the Hazard Profiles by IMCO. The changes were formally affirmed by the Group.

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7.5 The Chairman of the Working Group drew special attention to the fact that a decision had been taken at its eighth session to include in the assessment of hazards the notation of the existence of carcinogenic properties. At its ninth session the Working Group had adopted a rationale for the selection of those substances which in its view might present a hazard to man as a result of discharges from ships or accidental spillages or losses of containers. The Group expressed its approval of the approach adopted by the Working Group and its recommendations for action by the appropriate IMCO sub-committees. In

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doing so, however, it requested that in the rationale the meaning of "high" doses should be quantified.

7.6 The Group expressed reservations at the inclusion of trade named substances in the composite lists of hazard profiles on the grounds that many such substances were liable to have variable compositions depending on sources and time of manufacture and might even be totally changed. Accordingly, it recommended that trade-named substances should only be included in the composite list if the Working Group could be assured of their reasonably constant composition.

7.7 In the context of computer storage of the Hazard Profiles and data, the Chairman of the Working Group indicated that during the course of the week he and the IMCO Technical Secretary had had discussions with Mr. J. Huismans, Director of UNEP's International Register of Potentially Toxic Chemicals (IRPTC). The Director of the IRPTC indicated that three areas of assistance would be explored as a result of these discussions:

a) the computer storage, retrieval and updating of the composite list of Hazard Profiles and the production of copies of the complete listings as required by IMCO;

b) assistance with the provision of data required by the Working Group especially on occasions when they expressed difficulty in obtaining data; and

c) computer storage of the data sheets prepared by the Working Group recording the basis for their decisions and the data used in compiling the Hazard Profile for each substance.

7.8 The Group formally expressed its support for that collaboration between UNEP and the Working Group.

7.9 The Group approved the reports of the Working Group including the hazard profiles of substances listed in those reports and the proposal that it should hold two meetings within the following twelve months. In commending the Working Group on its work to date, the Group expressed its strong support for the preparation of a report that would revise and update the original Hazard Profile Rationale - GESAMP IV/19 Suppl.1 - and would include the appropriate sections and annexes of the individual reports. If possible that document should be available at the twelfth session of GESAMP with a view to its approval and subsequent publication in the GESAMP Reports and Studies.

8. REVIEW OF POTENTIALLY HARMFUL SUBSTANCES

8.1 The Working Group had not met during the intersessional period. The Group considered the short report prepared by the Chairman of the Working Group, who had been unable to attend the session.

8.2 In view of the concern expressed in that report, the Group reviewed the objectives of the Working Group and noticed that its task was extremely large and would have to be carried out in stages.

8.3 The terms of reference of the Working Group established at previous sessions of GESAMP were reconfirmed as follows:

"1. To prepare short referenced reviews on selected substances which will include an assessment of the following factors:

(i) the total amount of the particular substance(s) which reach(es) the marine environment (on a local, regional and global scale) with particular attention to the relative importance of land-based sources;

(ii) the fate (transport, distribution, transformation) in the marine environment; and

(iii) the effects on the marine environment and adjacent coastal areas, including direct and indirect effects on living resources, human health and amenities.

2. To produce a scientific evaluation of the harmful effects of substances released into the marine environment on living resources, human health, amenities and other legitimate uses of the marine environment and adjacent coastal areas."

8.4 It was understood that the Group would give priority to:

a) previously identified priority chemicals that showed increased levels in the environment;

b) chemicals that were not covered by existing conventions and previous hazard evaluations.

Furthermore it was suggested that evaluation of effects should concentrate on the effects observed under field (natural) conditions.

8.5 Some groups of pollutants (organo-silicones, used lubricants, oil dispersants, carcinogens), had been proposed for consideration of the Working Group. The Group was of the opinion that only a limited number of chemicals should be evaluated first by the Working Group.

8.6 The Group appointed Mr. A. Jernelov as the Chairman of the Working Group and Messrs. L. Magos and K. Wilson as members of the Working Group. The Group would be jointly sponsored by WHO, FAO, and UNEP, with WHO acting as lead agency. The offer of UNEP's International Register of Potentially Toxic Chemicals (IRPTC) to assist in the collection and processing of information needed for the work of the Working Group was noted with appreciation.

8.7 The Group expressed concern with regard to the funding of the Working Group and WHO was asked to contact UNEP, FAO, UN and IAEA on the matter during the intersessional period in order to find an appropriate solution to the problem.

9. INTERCHANGE OF POLLUTANTS BETWEEN THE ATMOSPHERE AND THE OCEANS

9.1 The Chairman of the Working Group introduced the report which had resulted from two meetings and which represented an integrated study of the principal terms of reference. A summary of the report is given in annex VIII.

9.2 The Group accepted the report with minor amendments (table of contents given in annex VIII) and agreed that it should be published in the GESAMP Reports and Studies.

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Task Group on Biogeochemical Cycles

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sources of information (e.g., Marine Pollution Information Centre, Plymouth, England; UN International Computing Centre, Geneva; UNEP International Register of Potentially Toxic Chemicals; FAO/IOC Aquatic Sciences and Fisheries Information System; IOC Marine Environmental Data Information System; previous GESAMP Reports and Studies, etc.).

The core of the Working Group met in Dubrovnik (22-23 February 1980) and drew up a complete time-table of activities, including meetings, up to the expected completion of the report by the Working Group in October 1981. It revised the composition of the Working Group as well as the list of contributors to the report, in the light of emerging requirements. Likewise, it improved the provisional structure of the report.

MEMBERS OF THE WORKING GROUP ON A REVIEW OF THE HEALTH OF THE OCEANS
(as at the meeting in Copenhagen)

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Task Group on Interface Flux Models

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9.3 The Chairman indicated that rapidly developing knowledge in the field of air-sea pollutant exchange was a basis for the continuation of the Working Group and the following terms of reference were agreed upon by the Group:

- a) Reassessment of the air-sea fluxes of the selected and possible new pollutants, including those involved in weather and climate processes.
- b) Investigation of the life cycle of the selected atmospheric pollutants involved in air-sea transfer, including gas-particle interconversion.
- c) Assessment of possible impacts of ocean pollutants on atmospheric processes.
- d) Development of scientific bases for future international programmes related to pollutant interchange and the effects of such pollutants on atmospheric properties and processes.
- e) To oversee the production of a detailed study plan for a pilot project on the interchange of pollutants between the Atmosphere and Semi-Enclosed Seas (INTERPASES) for the Mediterranean Sea and to summarize available knowledge from other regions pertaining to this subject.

9.4 The Group recognized that in relation to the assessment of air-sea fluxes, new data would probably be required. Accordingly the Working Group should advise on the feasibility of conducting a monitoring programme relevant to that task based, for example, on weather-ships.

9.5 The Group noted that WMO at its 8th Congress had taken a decision to promote a multi-media monitoring programme including in biosphere reserves and on weather-ships. In that context, the Group considered that the advice of the Working Group in relation to the assessment of air-sea fluxes would provide a useful input to the multi-media monitoring proposed by WMO.

9.6 It was also noted that the Working Group would be additionally valuable in that it would provide consultation and information on air-sea pollutant exchange to the Working Group on the Health of the Oceans.

10. SCIENTIFIC ASPECTS OF THE REMOVAL OF HARMFUL SUBSTANCES

10.1 In the absence of the Chairman of the Working Group, Mr. H. Thompson, the report of the Working Group was introduced by a member of the Working Group, Mr. F. El-Sharkawi. A summary of the report is given in annex IX.

10.2 The Group noted with concern that, due to financial constraints, it had not been possible to convene an intersessional meeting and the Working Group had had to conduct all its work through correspondence. In the light of that, the Group appreciated the strenuous effort made by the Working Group Chairman under those difficult conditions in the preparation of its report, which represented a considerable expansion of the previous report (GESAMP IV/19, Annex VI in 1972) with certain updating of the information contained therein.

10.3 The Group acknowledged the work that had been done, especially that performed by the Chairman of the Working Group. At the same time, some GESAMP members felt that the report still did not adequately cover some aspects of waste water treatment and disposal. For example, the report did not cover certain newer methods of treatment, castings were outdated and not readily comparable.

SUMMARY OF THE REPORT OF THE WORKING GROUP ON A REVIEW OF THE HEALTH OF THE OCEANS

Also, it was felt that, being largely based on U.S.A. experience, the report did not give a clear picture of experience elsewhere.

- 10.4 The Group agreed that in the form presented the report could be accepted and considered as a valuable internal document of GESAMP which could serve as useful reference material for other GESAMP working groups and other interested outside individuals. The WHO Technical Secretary agreed to provide, on request, copies of the document to meet such needs.
- 10.5 In view of the continued lack of interest and agency funds, the Group agreed that the Working Group should be disbanded and the task be regarded as completed for the present.

11. CRITERIA FOR THE IDENTIFICATION OF PARTICULARLY SENSITIVE SEA AREAS

- 11.1 The item was introduced by the IMCO Technical Secretary who drew the Group's attention to the response of the Consultative Meeting of Contracting Parties to the London Dumping Convention and of the IMCO Marine Environment Protection Committee which, with reference to the protection of particularly sensitive sea areas, had welcomed the information that GESAMP might provide scientific advice to IMCO in the form of guidelines for identifying such areas, including the factors to be taken into account in such identification, and compile a bibliography of available material. (Rep. Stud. GESAMP (9), paragraph 59).

Specifically, the Group noted that the Fourth Consultative Meeting of Contracting Parties to the London Dumping Convention, after considering the outcome of the tenth session of GESAMP (Rep. Stud. GESAMP (9)), had requested the Group to:

" (i) develop further the scientific criteria for the selection of sites (Rep. Stud. GESAMP (3)) taking into account the relevant publications of the International Council for the Exploration of the Sea, so as to minimize the effect on the marine environment of the waste or other matter which is dumped.

(ii) to compile a bibliography of available material."

- 11.2 The Group further noted that the Marine Environment Protection Committee of IMCO had accepted the offer of GESAMP as stated in paragraph 1 above and that the IMCO Technical Secretary had been requested to submit a progress report to the Committee in late 1980.

- 11.3 The IMCO Technical Secretary accordingly proposed that a working group be set up. In discussing possible terms of reference it was recognized that they could be restricted to specified disposal operations, or could be expanded to embrace the development of criteria leading to guidelines for identifying areas particularly vulnerable to marine pollution from a wide range of sources. Some members of GESAMP were concerned that the Working Group might be given a task which was too vague and open-ended, and that there might be a substantial overlap with other GESAMP working groups. To prevent such an overlap it was proposed that working groups with interlocking interests should make every effort to maintain good inter-communication. After considerable discussion, it was agreed that the new Working Group's formal terms of reference should be restricted to the single task of reviewing and updating Rep. Stud. GESAMP (3), but it was understood that, in reporting to GESAMP XII, the Working Group would suggest a more detailed approach to the wider

The Working Group met in Copenhagen, 5-11 July 1979. It had the following terms of reference:

- " (i) to provide succinct periodic (3-4 years) critical reviews and scientific evaluation of the influence of pollutants on the state of the marine environment;
- (ii) to advise on the extent to which potentially harmful substances, processes or activities may affect the health of the oceans and the various uses of the marine environment;
- (iii) to advise on areas requiring further examination either because of their relatively higher degree of contamination or lack of detailed accurate information."

The Working Group decided to approach the problem from four angles: interface flux models, biogeochemical cycles, toxic substances and geographical areas. Four task groups were formed accordingly, each with a group leader.

The task group on interface flux models divided its work into four sub-sections, each with a taskmaster responsible for stimulating and co-ordinating the contributions from the scientists (members of the Working Group or otherwise) to be asked to collaborate.

Each group leader will be assisted by 6-12 experts in the fields covered by his group.

It was not considered necessary to form a task group on the organism-water and organism-sediment interfaces at this stage; these questions would be taken up by the present task groups if appropriate to their particular work.

Although all important processes were taken up by the task group on interface flux models, only certain biogeochemical cycles (mercury, lead, copper, selenium, tin, and possibly arsenic) will be covered by the respective task group as examples relevant to biogeochemical cycles generally and to the "health of the oceans" in particular.

Likewise, the task group on toxic substances will only deal with a few examples within four categories:

- (i) petroleum hydrocarbons;
- (ii) sewage (urban and domestic);
- (iii) synthetic organics related to PCBs and dioxine, and
- (iv) plutonium and other transuranic elements.

The task group on geographical areas will summarize and evaluate information on major marine areas starting with the Baltic Sea, the North Sea and the Mediterranean Sea, as pilot areas.

The schedule of work for the first intersessional period was planned and the structure of the Working Group's report was briefly considered, together with likely

issues referred to above, which could then be considered by GESAMP at that session. The agreed terms of reference of the new Working Group on Sea Disposal Studies were

"To review and update Rep. Stud. GESAMP (3) - Scientific Criteria for the Selection of Sites for Dumping of Wastes into the Sea, and compile a bibliography of relevant material".

- 11.4 With regard to the development of guidelines for identifying sensitive sea areas for vessel-source pollution, the Group noted that the Working Group on the Review of the Health of the Oceans, in the course of its discussions, would take into account that aspect.
- 11.5 The Group appointed Mr. A. McIntyre as Chairman of the Working Group. The Working Group would include several GESAMP members and experts from outside GESAMP to be nominated by IMCO in consultation with the Chairman of the Working Group and the co-operating organization. The first meeting of the Working Group was planned to be held in London in summer 1980.

12. FUTURE WORK PROGRAMME

Marine Pollution Implications of Ocean Energy Exploitation

- 12.1 The Group discussed the proposal presented by the United Nations Technical Secretary that it should consider the marine pollution implications of ocean energy exploitation. The proposal differed from the earlier version presented during the discussion of the biological effects of thermal discharges in the marine environment, in that it was restricted to unconventional ocean energy.
- 12.2 The experts noted the importance and timeliness of considering the subject and recommended that a new working group be formed to undertake the task in the intersessional period. Although the thermal effects of ocean energy exploitation were related to those to be studied by the Working Group on the Biological Effects of Thermal Discharges in the Marine Environment, it was decided that the two Working Groups would be kept separate but in close communication.
- 12.3 The terms of reference which are adopted by the Group were as follows:
 - a) To review the current literature and results of ongoing research and describe the marine pollution implications of the exploitation of the major sources of unconventional ocean energy with special reference to coastal areas and multiple-use concepts, particularly in developing countries;
 - b) To discuss the long-term environmental impacts to be expected from extensive ocean energy exploitation at the global level.
- 12.4 Mr. R. Gerard was appointed as Chairman of the Working Group. UN would act as lead agency.

The WMO and UNESCO Technical Secretaries expressed interest in the subject and contemplated the willingness of their organizations to co-operate with the work of the Working Group. (The participation of WMO would be subject to approval by its Headquarters).

Interessional Activities

12.5 The Group noted that interessional work would continue or be initiated by Working Groups on the following subjects, with an indication of the sponsoring organization responsible for organizing the interessional work, the Chairman and the Working Groups within GESAMP:

(a) Review on the Health of the Oceans:

Lead Agency : UNESCO

Co-operating Agencies : All other GESAMP sponsors

Chairman: G. Kullenberg

Members: W. D. Garrett
A. Jernelev
L. Magos
A. McIntyre
G. T. Needler
J. Portmann
V. Pravidic
E. Tutuwan

(b) Oceanographic Model for the Dispersion of Waste Disposed of in Deep Sea:

Lead Agency : IAEA

Co-operating Agencies : IMCO, UNESCO and UNEP

Chairman: G. T. Needler

Member: G. Kullenberg

(c) Sea Disposal Studies:

Lead Agency : IMCO

Co-operating Agency : UNEP

Chairman: A. McIntyre

Members: F. El-Sharkawi
J. Portmann
E. Tutuwan
J. W. Van Rijn Van Alkenade
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(d) Review of Potentially Harmful Substances:

Lead Agency : WHO

Co-operating Agencies : FAC and UNEP

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RELATED TO MARINE POLLUTION
(to be published as GESAMP Rep. Stud. No. 12)

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ANNEX I MEMBERSHIP OF THE WORKING GROUP

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Chairman: A. Jernelev

Members: L. Magos
K. Wilson

(e) Evaluation of the Hazards of Harmful Substances Carried by Ships:

Lead Agency : IMCO

Chairman: J. Portmann

(f) Biological Effects of Thermal Discharges in the Marine Environment:

Lead Agency : FAO

Co-operating Agencies : UNESCO and UNEP

Chairman: V. Pravidic

(g) Interchange of Pollutants Between the Atmosphere and the Oceans:

Lead Agency : WMO

Co-operating Agency : UNEP

Chairman: W. D. Garrett

Members: R. Chesselet
V. Pravidic

(h) Marine Pollution Implications of Ocean Energy Development:

Lead Agency : UN

Co-operating Agency : WMO* and UNESCO

Chairman: R. D. Gerard

Members: A. Jernelev
G. Kullenberg
P. da Silva
A. Simonov

* subject to approval by Headquarters

13. DATE AND PLACE OF NEXT SESSION

13.1 The Group noted that the next (twelfth) session of GESAMP would be held from 22-28 October 1981 and would be preceded by the meeting of the Working Group on a Review of the Health of the Oceans (19-21 October 1981) to which all members of GESAMP would be invited.

13.2 Subject to WMO approval both meetings would be arranged at its Headquarters in Geneva.

SUMMARY OF THE REPORT OF THE WORKING GROUP ON MONITORING OF BIOLOGICAL VARIABLES RELATED TO MARINE POLLUTION

14. OTHER MATTERS

14.1 The Group expressed its disquiet over certain difficulties that had become increasingly manifest in recent years. The pressure, on experts and agencies alike, to plan their meeting calendars more and more in advance, made it essential to fix dates of future GESAMP meetings (including those of working groups) as far in advance as possible so that plans for attendance at a meeting, and the arrangements therefore, could be made and adhered to. Documents to be considered carefully or approved at a session should be in the hands of the experts and the sponsoring agencies at least one month in advance of the meeting to which they referred. Similar considerations applied to travel arrangements for the experts.

14.2 The Group pointed out to the sponsoring agencies that, to be able effectively to respond to the increasingly numerous and complex demands being made on it, it must have a sufficiently large and specialized enough composition. It felt that each sponsoring agency should nominate its full quota of three experts to each session of the Group. Considerable concern was expressed over the small attendance at the current session.

14.3 Sponsoring agencies were requested to provide new members of the Group with previous GESAMP reports (especially that of the previous session) and other background information, including the technical memorandum on GESAMP, so that they would have a good perspective of the Group's purposes and work. The agencies were also asked to provide the Group's members with a one-paragraph summary of each expert's background and current interests prior to each meeting, as part of the pre-meeting documentation.

14.4 To facilitate the ever more complex intersessional work, the Chairman, Working Group Chairmen and Technical Secretaries were asked to copy important correspondence and, where relevant, brief progress reports on working group activities to each other, as appropriate. The same procedure should also apply to documents prepared for one working group but of interest to other working groups.

14.5 The Group recommended that the requests from the technical secretaries for specific activities should, in the future, be clearly stated and identify the final user of the products (reports, recommendations, developments etc.), commitments of the sponsors to the finalization of the products (in particular if it was expected to be reached through a working group) and any other matter related to the work of GESAMP.

15. ELECTION OF CHAIRMAN AND VICE-CHAIRMAN FOR THE NEXT INTERSESSIONAL PERIOD AND FOR THE TWELFTH SESSION

15.1 The Group unanimously decided to extend the mandate of Mr. V. Pravdic as Chairman and Mr. A. D. McIntyre as Vice-Chairman for the next intersessional period and for the twelfth session of GESAMP.

16. CONSIDERATION AND APPROVAL OF THE REPORT OF THE SESSION

16.1 This report of the XIth session of GESAMP was considered and approved by the Group on the final day of the session.

The Working Group studied the problems associated with measuring biological variables related to marine pollution, and concluded that the case was established for incorporating such measurements in monitoring programmes.

In discussing the scientific requirements for biological monitoring, the Working Group proposed a set of principles for selecting suitable variables. It then evaluated a selection of possible variables in the light of these principles, and listed a group of measurements which could be recommended for immediate inclusion in monitoring programmes. They comprised certain biochemical and physiological procedures as well as a number of morphological, population and community measurements.

In addition to these approaches, which are sufficiently well developed for immediate use as monitoring tools, there are others which show promise, but require further study. It is recommended that countries with well developed research organizations should take the lead in such development.

The Group noted the lack of any general framework for applying biology to monitoring programmes. It therefore developed a three-part strategy for biological monitoring and provided guidelines for implementing it. The strategy recognizes that appropriate chemical analysis is always required and that the biological input is most effectively deployed in a suite of procedures carefully tailored to the requirements of individual programmes.

The Group studied a number of current projects and for the most advanced of these suggested some additional biological measurements which could be employed. It is recommended that concerted efforts be made to apply the strategy in existing local and regional programmes and to build it into new programmes at the planning stage. Existing methods should be used since significant advances are more likely to follow at present from examination of practical experience than from new theoretical or laboratory exercises. After the strategy has been applied for a time, its performance should be reviewed and modified as necessary.

On the subject of open ocean monitoring, the Group recognised substantial problems at the present time. It suggested that biological monitoring carried out in this area might be most usefully focused on the benthos at a few sites specially selected for their stability and where the benefits of other relevant on-going research efforts would be available.

Finally, the need for training in some of the biological techniques was discussed. It was proposed that this could be provided for by visits from experts, by lectures and courses, and by periods of training at selected centres of expertise. The value of collecting methods in a manual was noted.

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AGENDA

- Opening of the meeting
1. Adoption of the agenda
 2. Marine pollution implications of coastal area development
 3. Monitoring of biological variables related to marine pollution
 4. Review on the health of the oceans
 5. Oceanographic model for the dispersion of waste disposed of in deep sea
 6. Biological effects of thermal discharges in the marine environment
 7. Evaluation of the hazards of harmful substances carried by ships
 8. Review of potentially harmful substances
 9. Interchange of pollutants between the atmosphere and the oceans
 10. Scientific aspects of the removal of harmful substances from waste water
 11. Criteria for the identification of particularly sensitive areas
 12. Future work programme
 13. Date and place of next session
 14. Other matters
 15. Election of Chairman and Vice-Chairmen for the next intersessional period and for the twelfth session
 16. Consideration and approval of the report of the session

Special Notes on Wastes Discharged in Coastal Areas
Sewage

The characterisation of waste waters
The natural characteristics of the receiving marine
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The definition of quality criteria
The feasibility of preventive actions
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TECHNICAL APPENDIX A - Treatment of oceanographic data

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TABLE OF CONTENTS OF THE GESAMP REPORT ON MARINE POLLUTION IMPLICATIONS
OF COASTAL AREA DEVELOPMENT
(to be published as GESAMP Rep. Stud. No. 11)

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LIST OF DOCUMENTS

GESAMP No.	Agenda item	Author, Source	Title
XI/1/Rev.1	1	Administrative Secretary	Agenda for the eleventh session
XI/1/1	1	Administrative Secretary	Annotated agenda
XI/2	7	Working Group	Evaluation of the hazards of harmful substances carried by ships
XI/2/1	7	Working Group	Evaluation of the hazards of harmful substances carried by ships
XI/3	8	Chairman of Working Group	Review of potentially harmful substances
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XI/5	2	Working Group	Marine pollution implications of coastal area development
XI/6	10	Chairman of Working Group	Scientific aspects of the removal of harmful substances from waste water
XI/6	10	INCO	A note on scientific aspects of the removal of harmful substances from waste water
XI/7	5	A. Thorhaug	Biological Effects of Thermal Effluents in the Marine Environment: Tropics and Subtropics; with a guideline (Summary)
XI/8	3	Working Group	Monitoring of biological variables related to marine pollution
XI/9	4	Working Group	Review of the health of the oceans

XI/9/Add.1	4	Working Group	Review of the health of the oceans	SUMMARY OF THE REPORT OF THE WORKING GROUP ON MARINE POLLUTION IMPLICATIONS OF COASTAL AREA DEVELOPMENT
XI/10	11	IMCO	Criteria for the identification of particularly sensitive sea areas	The purpose of this report is to give basic guidelines for the assessment of the effects of coastal area development on the marine environment and its resources. It was particularly designed to provide assistance to developing countries and offers a practical guide for users having limited scientific, technical and/or economic resources.
XI/10/1	11	IMCO	Criteria for the identification of particularly sensitive sea areas	The first of the two major sections of the report presents a basic programme of observations which would provide the fundamental data required for a preliminary evaluation of the marine pollution implications of planned coastal areas development. The programme covers applications of such techniques as aerial and remote sensing and includes a discussion of navigation and positioning.
XI/Inf.1		IMCO	Recent activities of IMCO in the field of marine pollution	Considerations related to known sources of pollution are also discussed. Sewage and industrial wastes discharges have been examined with regard to engineering approaches for treatment and outfall design as well as methods for determining the nature of industrial wastes and their relative importance, and methods of applying analytical information to the design of industrial waste treatment discharge facilities.
XI/Inf.2		FAO	Summary report of activities of FAO in the field of marine pollution	Important considerations which should be taken in relation to special coastal environment, such as estuaries and island ecosystems have been included. In addition to these, coastal conditions such as climate, wave, swell and oceanic current systems have been examined within the context of the basic programme of observations.
XI/Inf.3		UNESCO/IOC	A report on the work of UNESCO and the IOC in relation to marine pollution since the tenth session of GESAMP	The second major section presents a methodology for determining the implications of coastal area development activities. Basic site selection criteria for various coastal area activities have been presented and pollution assessment matrices developed within the context of an overall decision-making process. Special notes on wastes discharged in coastal areas and sewage in particular are included in this section.
XI/Inf.8/Corr.1		UNEP	Information on UNEP's regional seas programme	In addition to tables summarizing physical and chemical oceanographic observations of the basic programme, diagrams depicting observational methods and a bibliography are included. Finally, six illustrative examples applying the observational programme and the matrix methodology have been prepared covering the following coastal area activities:
XI/Inf.9		WMO	A report on the work of WMO in relation to marine pollution since the tenth session of GESAMP	<ol style="list-style-type: none"> 1. Tourism and recreation 2. Pulp and paper mills 3. Port and harbour development 4. Mining of construction materials 5. Oil terminal installation 6. Municipal sewage disposal

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