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

REPORTS AND STUDIES

No. 4

1976

**REPORT OF THE EIGHTH SESSION
ROME, 21-27 APRIL 1976**



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

REPORTS AND STUDIES No. 4

IMCO/FAO/UNESCO/WHO/WHO/IAEA/UN Joint Group of Experts
on the Scientific Aspects of Marine Pollution (GESAMP)

REPORT OF THE EIGHTH SESSION
Rome, 21 - 27 April 1976

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 1976

NOTES

1. GESAMP is an advisory body consisting of specialized experts nominated by the Sponsoring Agencies (IMCO, FAO, UNESCO, WMO, WHO, IAEA, UN). Its principal task is to provide scientific advice on marine pollution problems to the Sponsoring Agencies and to the Inter-governmental Oceanographic Commission (IOC).
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IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN
JOINT GROUP OF EXPERTS ON THE SCIENTIFIC
ASPECTS OF MARINE POLLUTION

Report of the Eighth Session

(FAO Headquarters, Rome, 21 - 27 April 1976)

OPENING OF THE MEETING

1. The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) held its eighth session at FAO Headquarters, Rome, from 21 - 27 April 1976. The Chairman of GESAMP, Dr. G. Kullenberg, opened the session.
2. Dr. H. Kasahara, Director, Fishery Resources and Environment Division of FAO, welcomed the experts, the representatives of the sponsoring agencies and the observers from other organizations attending the session. He stressed the importance which his Organization attaches to the work of GESAMP and wished the Group success in its work during the session.
3. The agenda of the eighth session, as adopted by the Group, is attached as Annex I. A list of documents considered by the Group under each agenda item is shown in Annex II. This also includes a list of information papers summarizing the recent activities of the sponsoring agencies in the field of marine pollution or relating to matters under discussion.
4. A list of participants, comprising the experts, observers from interested organizations and the representatives of the sponsoring agencies, is shown in Annex III. The Group regretted that Dr. R.D. Gerard, Dr. L. Machta, Dr. A.I. Simonov and Prof. E. Vigliani, nominated by the sponsoring agencies as experts, could not attend the session.

EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES IN THE MARINE ENVIRONMENT

5. The Group noted the Report on the Evaluation of the Hazards of Harmful Substances in the Marine Environment (GESAMP VIII/2) submitted by IMCO and presented by the Administrative Secretary, Mr. Sasamura. The Report contained a summary of action taken by the IMCO Marine Environment Protection Committee (MEPC) following their consideration of the Reports of the two meetings of the Working Group on Evaluation of the Hazards of Harmful Substances in the Marine Environment. The attention of the Group was drawn to the problems encountered by the working group in obtaining data, particularly data on acute toxicity for marine species, and in the evaluation of the hazards posed by substances and materials listed and transported under trade names.
6. The Administrative Secretary referred to the formation of a new IMCO Sub-Committee on Bulk Chemicals (BCH) which would deal with the carriage of chemicals in bulk and which would be a subsidiary body to both the Maritime Safety Committee and the MEPC. The new Sub-Committee will hold its first session in May 1976 when it is expected that the relative roles of the two bodies will be confirmed.
7. The Reports of the Second and Third Sessions of the Working Group on the Evaluation of Hazards of Harmful Substances in the Marine Environment, held at IMCO Headquarters, London, 4 - 6 June 1975 and 15 - 17 October 1975, were introduced by the Chairman, Dr. P.G. Jeffery (GESAMP VIII/2/1).
8. It was noted that for all substances considered at the two meetings of the working group the data upon which the hazard profiles had been based were being gathered together on 'data sheets' retained at IMCO Headquarters for future reference.

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9. Concern was expressed that information needed by the working group and only available in commercial undertakings was not being made available to it. The Chairman of the working group explained that this could indeed be a problem, but that so far it had been found possible to obtain the answers to specific questions. The International Chamber of Shipping and other organizations had been particularly helpful in obtaining data on such matters as the identity and concentration of inhibitors added to certain substances. Information was sometimes provided in confidence.

10. Concern was also expressed that, in spite of considerable emphasis on the need to produce new data, particularly in respect of acute toxicity for marine species, not enough material had so far been made available to the working group in its task of hazard assessment. Discussion had taken place on this topic at the seventh session of GESAMP, and it was noted that information was now forthcoming and there were hopes that experimental work would be commissioned to provide data not otherwise available.

11. It was agreed that a list of laboratories known to be active in toxicity testing might be useful for the future organization of the tasks of the working group and it was suggested that such a list should be developed. The list appended to the report of the working group was considered by the Group to be inadequate and incomplete, and it was agreed that the list should be deleted from the working group's report.

12. Some members questioned the methodology used in hazard evaluation, particularly in respect of the hazards to human health. The Chairman of the working group responded that the working group had continued to use the methodology developed and adopted at the fourth session of GESAMP (GESAMP IV/19/Supp. 1) which had been used by IMCO as the basis for the categorization of chemical substances for the preparation of Annex II of the International Convention for the Prevention of Pollution from Ships (London, 1973). The Group accordingly agreed that it would not be appropriate to attempt to revise the present methodology, and reaffirmed the position taken at the fifth session, namely that the hazard profile contained in GESAMP IV/19/Supp. 1 had been developed for the particular conditions and circumstances in which the substances might be expected to be discharged from ships, and this methodology should not be used for the control of discharges from other sources (GESAMP IV/19, paragraph 11).

13. The Group was informed that as the Review of Harmful Substances was not yet available in its published form, the working group had not made any attempt to carry out the task of making a revision of this document. In this connexion it was recognized that the two tasks relate to different audiences, and several members suggested that the task of updating the review should be dealt with separately from the task of hazard evaluation for IMCO, and undertaken by a separate working group. This was agreed by the Group and further discussion of the terms of reference of the new working group are dealt with in paragraphs 15-19. The Group also agreed that the existing working group which will deal with IMCO work only, should be renamed the Working Group on the Evaluation of the Hazards of Harmful Substances carried by Ships.

14. Subject to the comments mentioned in the above paragraphs and with the amendments agreed by it, the Group approved the reports of the second and third sessions of the working group and requested the IMCO Technical Secretary of GESAMP to transmit them to the relevant IMCO bodies.

REVIEW OF HARMFUL SUBSTANCES IN THE MARINE ENVIRONMENT

15. As agreed during the plenary discussion on the updating of the Review of Harmful Substances, an ad hoc working group was convened for the purpose of defining terms of reference for a new GESAMP working group. After a review of both the UN General Assembly Resolution 2566 (XXIV) and the Stockholm Conference Resolution 88, the ad hoc working group recommended that the proposed Working Group on the Review of Harmful Substances should have the following

terms of reference:

- to update the Review of Harmful Substances (GESAMP Reports and Studies, No. 2, New York, 1976) with greater emphasis on the human health aspects of marine pollution,
- to continue to include consideration of the other aspects of the subject, namely: harm to living resources, reduction of amenities and interference with other uses of the sea.

16. The ad hoc group recommended that priorities should be set in order to focus initial attention upon those agents of particular significance to human health, and also recommended that:

- (a) WHO prepare a list of agents to be evaluated on the basis of actual and potential human health hazards associated with the marine environment
- (b) The proposed working group endeavour to design and use uniform data sheets
- (c) Long-term and chronic effects such as carcinogenesis and mutagenesis be adequately considered whenever possible.

17. In selecting agents and their risk evaluation, the following factors should be considered:

- (a) The total quantities discharged, fluxes, and/or concentrations of harmful substances before they enter the sea. Purposes for which they were originally used, and their physico-chemical characteristics, including probable reaction paths, should also be stated.
- (b) The routes by which they may enter the sea and the likelihood of such entry, taking into account both sea-based and land-based sources and atmospheric fallout. The characteristics of the sea in the area where the introduction takes place should be noted.
- (c) The degree of human exposure to these agents evaluated on the basis of their distribution and amounts present in sea water, sediments, flora and fauna, and especially in marine products likely to reach man. Such exposure should also be examined taking into account the presence of by-products and transformation products of the original substance.
- (d) The stability of the agents and of their derivatives, and the possibility of their causing environmental modifications (e.g. eutrophication).
- (e) Their bioaccumulation, especially along critical ecological paths.
- (f) Their toxicity profile including, whenever possible, such factors as structural considerations, general and specific toxicity, long-term and mutagenic effects, interaction between toxic agents themselves and between toxic agents and the environment.
- (g) The special importance of sensitive groups of population and of particular pathways.
- (h) An assessment of the scale of risk for the human population considered at large.

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18. The proposed working group should be asked in planning its work to pay particular attention to the report of the Working Group on the Principles for Developing Coastal Water Quality Criteria and the work done by the Working Group on the Evaluation of the Hazards of Harmful Substances. It was felt that the data sheets prepared by the latter group might provide useful examples although they were designed for a different purpose.

19. The Group approved the terms of reference as given in paragraph 15 and the programme of work as outlined in paragraphs 16 and 17, and decided to establish a Working Group on the Review of Harmful Substances consisting of Dr. B.H. Ketchum (Chairman), Dr. P.G. Jeffery (in his capacity as Chairman of the Working Group on the Evaluation of the Hazards of Harmful Substances carried by Ships), Dr. A.B. Jernelöv, Dr. P.R. Kamath, Dr. V. Kiortsis, Dr. A. La Fontaine, Dr. J.E. Portmann and Dr. E. Vigliani, as well as additional members, as required, from outside GESAMP, to be appointed by the Chairman in consultation with the WHO and UN Technical Secretaries of GESAMP.

IMPACT OF OIL ON THE MARINE ENVIRONMENT

20. The Working Group on the Impact of Oil on the Marine Environment submitted its final report which was prepared at its second session held at FAO Headquarters, Rome, 17 - 27 September 1975. The report consisted of three parts: I - summarizing the results of the deliberations of the working group and its conclusions and recommendations, II - elaboration of these conclusions in detail by a comprehensive literature review, and III - a bibliography containing about 1,500 references.

21. The Chairman of the working group, Dr. Thompson, introduced the paper and informed the Group that the discussions on its summary report of the first session submitted to the seventh session of GESAMP had been carefully considered by the working group in the preparation of the final report.

22. The report, the outline of which had been approved by the seventh session of GESAMP after a thorough discussion, deals with the sources of oil and their significance to the living resources, the routes and pathways by which oil becomes available to the resources, the analytical techniques used and problems encountered, chemical, physical and biological effects of oil, the potential carcinogenic risks to human beings and losses of marine food by tainting.

23. Each of the above topics had been assigned to one member of the working group who assumed primary responsibility for compiling data and prepared a working paper as a basis for the discussion at the second session of the working group. In addition the group made use of some papers prepared by outside experts.

24. It was generally agreed that the report covered the complex subject of the impact of oil on the marine environment, especially the effects on marine ecosystems and living resources, in a highly satisfactory way. The Group appreciated the great efforts undertaken by the working group. The comprehensive literature review and the bibliography contained in parts II and III were particularly appreciated.

25. Concern was expressed, however, about part I because the Group felt that there was some internal inconsistency between various sections. It was also stated that due to some redundancies in some sections of part I it was too long and it was decided to set up an ad hoc working group to draft a shortened version for reconsideration by the plenary.

26. The ad hoc working group prepared the revised version of Part I which followed the outline of the chapters contained in Part II and summarized the information given therein by (a) defining the problems, (b) listing the observations and facts, and (c) giving the findings of the working group.

27. The Group, after another thorough discussion of the revised version of part I which led to some further changes and amendments, approved this version. With the understanding that

an editorial group consisting of some members of the working group will similarly prepare a revised version of part II which is generally accepted by the working group, the Group agreed that the report on the impact of oil on the marine environment (parts I-III) should be published by FAO as No. 6 of the GESAMP Reports and Studies. The content page of the report, together with a list of the working group's members and of the working papers used for the preparation of the report, is attached as Annex IV.

28. During the discussions it was noted that monitoring data on observations of petroleum slicks will soon be available from the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project. It would be useful, therefore, if the Joint IOC/WMO sub-group of experts on the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project could examine the project data with a view to establishing the extent of petroleum slick coverage of the ocean surface areas monitored. Special attention should be given to coastal regions, estuaries and certain semi-enclosed seas where petroleum slicks are expected to occur most frequently.

29. With regard to the finding of the working group that the analytical technology has not yet reached the state where standardized methods can be recommended the Group noted that for the purpose of the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project a common working methodology has been adopted.

INTERCHANGE OF POLLUTANTS BETWEEN THE ATMOSPHERE AND OCEANS

30. A document on this subject (GESAMP VIII/5) was introduced by the WMO Technical Secretary of GESAMP. He recalled that the WMO Executive Committee, at its twenty-sixth session, endorsed the proposal of GESAMP to establish an ad hoc group on Interchange of Pollutants between the Atmosphere and Oceans. The seventh session of GESAMP asked this group to identify the scope of studies and to draw up a working paper outlining and summarizing the contents of the studies related to this problem.

31. A meeting of the ad hoc group, combined with the session of the WMO/IOC Task Team on Methodology for Monitoring Pollutants (especially petroleum hydrocarbons) entering the sea from the atmosphere, was held during the intersessional period. It was agreed that Dr. L. Machta, Chairman of that meeting, would present the view of the group at the eighth session of GESAMP.

32. Dr. L. Machta had been nominated by WMO as a GESAMP expert but he was unable to participate at this session of GESAMP. In his absence the outcome of the meeting of the ad hoc group was presented by Dr. W.D. Garrett.

33. He reported that the ad hoc group was informed of GESAMP's agreement to consider at its eighth session the need to establish a new Working Group on Interchange of Pollutants between the Atmosphere and Oceans. The ad hoc group considered that, if such a working group is established, it should emphasize the physical and chemical processes at the air-sea interface that directly or indirectly control the exchange of pollutants between air and sea. It was understood that in addition to pollutants and contaminants, the exchange of other constituents and properties should also be considered, inasmuch as these are related to the understanding of the processes of exchange of pollutants.

34. It was also agreed that such a working group should emphasize the regional and global aspects of the effects of pollution at the interface, the transport of pollutants through the interface, and their influence on the geophysical processes in the atmosphere and oceans, especially those which may influence large-scale phenomena and climate.

35. The possible terms of reference for this working group developed by the ad hoc group were presented for consideration by GESAMP in document GESAMP VIII/5.

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36. Dr. R. Chesselet informed the session about the proceedings of an International Workshop on the Tropospheric Transport of Pollutants to the Ocean held in Miami, Florida, in December 1975. This Workshop was organized by the United States National Committee for SCOR of the US National Academy of Sciences with partial support from the IOC. It provided basic important scientific interactions between chemists, meteorologists and specialists in mathematical modelling. The TTPO steering committee had agreed that Dr. R. Chesselet give an informal presentation to GESAMP of the main recommendations issued by this Workshop. One of these recommendations is that strong international action should be taken.

37. Discussing this item the Group agreed that there is a need for a working group on this problem but that the proposed terms of reference seemed rather broad and priorities should be recommended. Interest was expressed by Group members on the life cycle of pollutants in the atmosphere with special emphasis on gas-particle interconversion and photochemical oxidation. In addition, modifications of the air-sea interface and of atmospheric processes by certain pollutants or contaminants were cited as being of great importance. Finally, the transport of pollutants across the air-sea interface into the atmosphere was identified as a possible area of interest. Study of the sea-to-air-to-land transport of this kind was considered to be urgent in coastal areas heavily polluted by sewers or municipal dumping. It was also pointed out that experiences with smaller water bodies regarding the modification of air-water exchange might give guidance to assess open-ocean conditions. Specifically mentioned were the retardation of evaporation of water from reservoirs with organic monolayers and the effect of high detergent concentrations on oxygen exchange in a riverine situation.

38. Terms of reference for the proposed working group were drawn up as follows:

- (a) To carry out a review of the state of knowledge in the field of interchange of pollutants between the atmosphere and the oceans.
- (b) To identify gaps in existing knowledge, to consider research needs, to suggest priorities and submit a report based on the following considerations:
 - (i) The air pollutants to be considered should be those that either enter the oceans in significant quantities on a regional and/or global scale, or that enter the atmosphere in significant quantities on a regional and/or global scale from the ocean; a list of harmful substances in the marine environment should be reviewed to identify those pollutants for which an atmospheric pathway might be important in causing adverse effects on marine resources and amenities, and which might directly, or indirectly, affect atmospheric processes and/or modify air-sea interfacial properties;
 - (ii) A preliminary assessment of the fluxes of the selected pollutants between the oceans and the atmosphere should be made;
 - (iii) The life cycle of pollutants in the atmosphere which have entered from the ocean should be studied with emphasis on gas-particle interconversion;
 - (iv) Ocean contaminants that might directly, or indirectly, affect atmospheric processes and those that could affect physical or chemical processes at the air-sea interface should be selected. The processes altered by the pollutants should be identified;

- (v) Mechanisms governing the interchange of pollutants between the atmosphere and the oceans at the interface, and their possible mathematical description, should be studied;
 - (vi) A survey of currently available methods of measurements and projected developments related to measurement of selected pollutants in the atmosphere and the oceans on a global scale should be prepared;
 - (vii) Guidelines for a monitoring programme for the determination of fluxes between the atmosphere and oceans should be developed;
- (c) To assess results of review studies of the relevant items above and to develop scientific bases for the international programmes in these fields.

39. The Group decided to establish a Working Group on Interchange of Pollutants between the Atmosphere and the Oceans and agreed that this group should give priority to the tasks listed under b(i) to b(v) of the above terms of reference. The Group also agreed that this working group should consist of Dr. L. Machta (Chairman), Dr. R. Chesselet, Dr. W.D. Garrett, Dr. A.B. Jernelöv, Dr. V. Pravdic and Dr. M. Waldichuk, as well as additional members, as required, from outside GESAMP, to be appointed by the Chairman in consultation with the WMO and Unesco Technical Secretaries of GESAMP.

PRINCIPLES FOR DEVELOPING COASTAL WATER QUALITY CRITERIA

40. The Working Group on the Principles for Developing Coastal Water Quality Criteria submitted its final report which was prepared at its second session held at the Inter-University Center for Postgraduate Studies in Dubrovnik (Yugoslavia) from 20 - 25 October 1975.

41. The Chairman of the working group, Dr. Waldichuk, introduced the paper and informed the Group that both the discussions about the preliminary report of the working group, which took place at the seventh session of GESAMP, and written comments received from a selected number of outside reviewers were taken into account in the preparation of the final report.

42. It was pointed out that additional principles had been developed at the second session of the working group and that all 21 principles were now classified according to: (a) goals, (b) methodology, and (c) implementation. An attempt was made to apply the principles in developing criteria for certain critical pollutants. DDT was chosen as an example because of the large amount of environmental information available on this compound and on its diverse effects on aquatic organisms and fish-eating birds. In the case of amenities, it was difficult to establish exposure-effect relationships; the working group concluded after considerable discussion that for protection of most amenities it is necessary at present to rely on a threshold value of perception.

43. The working group concluded that it has not completely fulfilled the terms of reference assigned to it. It soon became clear that the working group could not embark at all on actually formulating criteria and that its major goal must be the consideration and enunciation of principles. The working group felt that it has achieved that goal, and in so doing, has formulated a constructive approach to the first and second terms of reference concerned respectively with evaluating the nature and extent of problem areas and with the data required for the formulation of criteria. Furthermore, it has provided an extensive framework within which further effort should be directed.

44. The Group commended Dr. Waldichuk and the working group for its work which, in the opinion of the Group, takes careful note of the substance of the discussion held on this topic at the seventh session. On the other hand, it was felt that some amendments to, or minor changes in, the report would be desirable in order to make it more acceptable as a guideline for developing coastal water quality criteria.

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45. Consequently, an ad hoc working group prepared several amendments taking into account comments from the Group. These amendments clarified particularly certain principles, revised the example on DDT applying the principles, and reworded some of the recommendations to state more clearly the future action needed in formulating coastal water quality criteria.

46. After adoption of the amendments prepared by the ad hoc working group the Group decided that the report should be published by FAO as No. 5 of the GESAMP Reports and Studies. The content page, together with lists of the working group's members, outside reviewers and working papers used for the preparation of the report, are attached as Annex V.

SCIENTIFIC ASPECTS OF POLLUTION ARISING FROM THE EXPLORATION AND EXPLOITATION OF THE SEA-BED

47. The Chairman of the working group, Dr. Cole, introduced the report which resulted from three inter-sessional meetings over a two-year period and which represented a final stage of the initial work programme. The terms of reference of the working group were reviewed and the Group was reminded that additional subjects were given to the working group at the seventh session of GESAMP relating to coastal area development, requested by the UN Technical Secretary in the light of ECOSOC Resolution 1802 (LV), disposal of radioactive wastes on the sea-bed and into the deep sea floor, and incineration of wastes on ships at sea.

48. The Group considered that the broad range of subjects was, in general, well covered by the working group but that the material went beyond solely scientific aspects and an amended title was suggested: Aspects of Pollution Arising from Exploration and Exploitation of the Sea-bed. In addition, the Group felt that certain subjects, e.g. coastal area development, incineration of wastes on ships at sea, and disposal of radioactive wastes on the sea-bed and into the deep sea floor, were too far outside the original terms of reference to be included in the report of the working group and, although significant, should be removed from the report of the working group.

49. Some provisional considerations on the subject of coastal area development on which the working group had reflected were not discussed in detail by the Group; they are attached as Annex VI for further evaluation by the newly established Working Group on Marine Pollution Implications of Sea-bed Exploitation and Coastal Area Development (see paragraph 56).

50. Regarding the disposal of radioactive wastes on the sea-bed, it was noted that under the London Convention of 1972 on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters, the IAEA is entrusted with the responsibilities of defining "high-level" radioactive wastes or other "high-level" radioactive materials that may be considered unsuitable for dumping at sea and with making recommendations with respect to the considerations, conditions and criteria governing the issues of special permits for dumping other radioactive wastes or materials.

51. The Group was informed of the possibility of sea-bed disposal of high-level nuclear wastes discussed at the IAEA Symposium on Radiological Impacts of Releases from Nuclear Facilities into Aquatic Environments held at Otaniemi, Finland from 30 June to 4 July 1975. The implications of this disposal method are currently under investigation.

52. The Group discussed the section of the report dealing with incineration of wastes on ships at sea which presented the results of a carefully monitored United States test as well as the experience of certain European countries. These indicated that the development and application of the technique of incineration on special ships at sea might contribute materially to the total capacity for waste disposal without increasing the risk of damage to marine life.

53. With the inclusion of an expanded section on estuaries, which was taken from one of the working group's background papers, the Group accepted the working group report (as amended) for publication by the UN as No. 7 of the GESAMP Reports and Studies following

thorough editing during the intersessional period. The report will be supplemented by five annexes on: (1) Pollution arising from exploration and exploitation of manganese nodules, (2) Dispersion of fine-grained material and other physical aspects, (3) Petroleum and natural gas, (4) Sand and gravel, and (5) Potential pollution from marine mining on the continental margin. These annexes should be referenced and noted but not included in the publication, although the UN should maintain a limited supply to answer future requests for further information. The contents page of the working group report, together with lists of the working group's members and the working papers used for the preparation of the report, are attached as Annex VII.

54. The Group commended the working group for its excellent work on such a comprehensive subject and discussed the future programme of work for GESAMP in this field. The terms of reference of the working group had included the study of measures to prevent and control pollution arising from the exploitation of sea-bed minerals. Although in dealing with the separate categories of minerals the working group had considered important prevention and control measures related to each category of mineral, and some of these are mentioned in the report, time was not available for the broad general discussion that the subject would require. Moreover, it would be necessary to extend the range of expertise of the working group by appointing members with substantial practical experience of sea-bed exploitation and others with specialized knowledge of coastal engineering problems. In respect of petroleum, natural gas, and sand and gravel, there is already a substantial body of experience upon which to draw in formulating recommendations regarding control of pollution arising from these activities. Many other sea-bed mining activities, however, lie in the future, and assessments can only be made on the basis of research experience and technological considerations. Manganese nodule mining occupies an intermediate position.

55. With regard to the need to update the work, the Group concurred with the conclusion of the working group that no formal review by GESAMP would be required for sand and gravel for at least five years, whereas for oil and gas exploitation, manganese nodule mining, phosphorite mining and the mining of other minerals, GESAMP should be guided by the development of events. One item of considerable importance not covered by the working group was the pollution impact of tin mining which was strongly endorsed by GESAMP as a priority concern.

56. As a result of the discussion by the Group on the future work in this field and bearing in mind the priorities of the United Nations, the Group agreed to establish a new Working Group on Marine Pollution Implications of Sea-bed Exploitation and Coastal Area Development with the following terms of reference:

- (i) To examine, as a priority item, certain aspects of sea-bed exploitation not sufficiently covered to date, namely
 - (a) marine pollution arising from exploitation of tin in coastal areas,
 - (b) further study of dredging, including dredging for minerals and for maintenance of channels, but excluding the disposal of dredge spoils,
- (ii) 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.

57. The Group agreed that this working group should consist of Dr. H.A. Cole (Chairman for the inter-sessional period), Dr. R.D. Gerard, Dr. G. Kullenberg, Dr. L. Mendia and Dr. H. Waldichuk, as well as additional members, as required, from outside GESAMP to be appointed by the Chairman in consultation with the Technical Secretaries of the UN and other interested sponsoring agencies.

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DATE AND PLACE OF NEXT SESSION

58. The Group was informed that the UN would act as host agency for the ninth session of GESAMP which was tentatively scheduled to be held in New York in March 1977; the exact date to be determined later.

OTHER MATTERS

Scientific aspects of removal of harmful substances from waste water

59. The group discussed, on the basis of a working paper prepared by WHO, efficiencies of treatment plants in the removal of certain harmful substances, normally contained in waste water. The paper was introduced by the WHO Technical Secretary of GESAMP who explained the background and objectives for a study to be initiated by GESAMP. He pointed out in particular the need for a review of scientific aspects of the removal of substances which had been found to have definite harmful effects in the marine environment, by beginning to establish to what degree conventional treatment plants did limit the discharge of these substances to the marine environment.

60. Some concern was expressed that technology and economics might come into the study and that this would be beyond the scope of GESAMP. The FAO Technical Secretary of GESAMP stated that the approach to a study on the proposed subject, however, would be important, particularly as it can provide valuable guidance to developing countries where waste water discharges are continuously increasing. Although much information already exists, it was agreed that a review of scientific aspects involved would be a necessary premise to the proposed study.

61. Several members supported the proposal on condition that more specific terms of reference would be prepared. The Group concluded that WHO, in collaboration with FAO, may wish to start some preliminary work with the assistance of an ad hoc group, including some members of GESAMP, taking advantage of previous work of GESAMP as appropriate, particularly of GESAMP IV/19/Annex VI. A more specific proposal should be submitted to the ninth session of GESAMP.

Effects of thermal discharges on the environment

62. In agreement with the mid-term programme of GESAMP, that was agreed upon by the sponsoring agencies at an Inter-Secretariat meeting in January 1974, the FAO Technical Secretary of GESAMP submitted a paper on Effects of Thermal Discharges on the Marine Environment.

63. The paper stated that there is an increase in the public and official consciousness of the impact of technical progress on the human environment, that the annual production of heated water will grow continuously, that this type of pollution may have deleterious effects on living resources and that it may become particularly important for developing countries in tropical areas. On the other hand, beneficial use of heated water has also to be taken into account and, at various places, it is already used for aquaculture and agriculture.

64. In view of these facts the paper therefore concluded that GESAMP may wish to consider setting up a working group to review the situation on a broad inter-disciplinary basis.

65. The Technical Secretary of FAO, however, informed the group that very recently Unesco has established a working group on investigations on the effects of thermal discharges as part of its International Hydrological Programme (IHP) which will not only deal with effects of heated water on lakes, rivers and reservoirs but also with estuaries and seas.

66. The discussion of the Group on this matter stressed the importance of the problem and the need to develop scientific guidelines for the siting of power plants on the coasts. Also discussed at length was whether the setting up of a GESAMP working group would lead to a duplication of work taking into account the IHP group on a similar subject.

67. The Group felt that the only field of overlapping would be in the field of estuaries whilst with regard to coastal waters and the seas the real expertise would be with GESAMP bearing in mind the role of GESAMP as a special advisory group on marine pollution. It was therefore decided to establish a Working Group on Biological Effects of Thermal Effluents in the Marine Environment with the following terms of reference:

To selectively review available information on the effects of thermal discharges on coastal waters with a view to developing guidelines for the siting of discharges of heated sea water so as to ensure that the harmful effects of heat on living marine resources are minimized.

68. The Group agreed that this working group should consist of Dr. G. Berge (Chairman for the inter-sessional period), Dr. L. Otto, Dr. V. Pravdic and Dr. C.H. Thompson, as well as additional members, as required, from outside GESAMP to be appointed by the Chairman in consultation with the Technical Secretaries of FAO and other interested sponsoring agencies.

69. In making this decision the group asked the Chairman of the newly established working group to contact the IHP working group in order to make use of the results of this group as far as possible.

Monitoring biological parameters of marine pollution

70. The Unesco Technical Secretary of GESAMP announced Unesco's interest in having GESAMP address further the problem of monitoring biological parameters of marine pollution. He informed the Group that Unesco would prepare, in the inter-sessional period, a proposal which would be put before GESAMP at its ninth session with a view to the formation of a working group to take up this subject which had presented considerable difficulties when previously considered by the Group in its work on the scientific bases of marine pollution monitoring.

Scientific advice in relation to the 1972 London Dumping Convention

71. The Group was informed that the First Consultative Meeting of the Contracting Parties to the 1972 London Dumping Convention was scheduled to be held at IMCO Headquarters, London, from 20 to 24 September 1976, and that the Meeting would consider, among other things, its future work programme including the invitation to a scientific advisory body or bodies to provide scientific advice in relation to the Convention.

72. The Group agreed that it was ready to provide advice to the Consultative Meeting on matters which fall within its terms of reference and within the resources available, if so requested by the Consultative Meeting through IMCO as a sponsoring agency for GESAMP. In this connexion it was suggested that a short note might be prepared by the Administrative Secretary of GESAMP for submission to the Consultative Meeting summarizing the past and current activities of GESAMP which would be of interest or useful to the Consultative Meeting.

Definition of term "pollution of the marine environment"

73. The Administrative Secretary informed the Group that he had received a request from the Chairman of the Third Committee of the United Nations Conference on the Law of the Sea (Professor A. Yankov) for advice by the Group on the proposed amendments to the definition of the term "pollution of the marine environment" which were raised at the current session of the Law of the Sea Conference (New York, 15 March - 8 May 1976).

74. The amended definition proposed reads as follows:

"Pollution of the marine environment" means: the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) which results or is likely to result in such deleterious effects as harm to living

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or non-living resources, hazards to human health, hindrance to marine activities including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities."

75. It was the general feeling of the Group that the working definition of "marine pollution" agreed by the Group in 1969 (GESAMP I/11, paragraph 12) with slight amendments in 1972 (Updated Memorandum on GESAMP, 4 August 1972) had been satisfactory for the work of GESAMP. The Group agreed, therefore, that there was no particular need to introduce any further amendments to its working definition of marine pollution.

76. The Group briefly discussed the desirability and practical effect of the amendments as requested by the Third Committee of the UN Conference on the Law of the Sea, and gave advice to the Administrative Secretary on the type of response he should make to the Chairman of the Third Committee.

Future work programme

77. The Group noted that the working groups on the following subjects had now completed their current work, and accordingly agreed that they should be disbanded at the conclusion of the eighth session:

- (1) Principles for developing coastal water quality criteria;
- (2) Impact of oil on the marine environment;
- (3) Scientific aspects of pollution arising from the exploration and exploitation of the sea-bed.

78. The Group expressed appreciation to all the Chairmen and members of the above working groups, both from within and outside GESAMP, who had contributed to the inter-sessional work. The Group also expressed appreciation for the financial support given by UNEP for the work of these working groups.

79. With regard to its future work the Group requested the following working groups to initiate or continue the tasks during the inter-sessional period:

- (1) Evaluation of the hazards of harmful substances carried by ships;
- (2) Review of harmful substances;
- (3) Interchange of pollutants between the atmosphere and the oceans;
- (4) Marine pollution implications of sea-bed exploitation and coastal area development;
- (5) Biological effects of thermal effluents in the marine environment

ELECTION OF CHAIRMAN AND VICE-CHAIRMAN FOR THE NEXT INTER-SESSIONAL PERIOD AND FOR THE NINTH SESSION

80. The Group unanimously re-elected Dr. G. Kullenberg as Chairman and Dr. C.H. Thompson as Vice-Chairman for the next inter-sessional period and the ninth session of GESAMP.

CONSIDERATION AND APPROVAL OF THE REPORT.

81. The present report of the eighth session of GESAMP (GESAMP VIII/11) was considered and approved by the Group on the last day of the session.

ANNEX I

AGENDA

Opening of the meeting

1. Adoption of the Agenda
2. Evaluation of the hazards of harmful substances in the marine environment
3. Updating of the Review of Harmful Substances
4. Impact of oil on the marine environment
5. Interchange of pollutants between the atmosphere and the oceans
6. Principles for developing coastal water quality criteria
7. Scientific aspects of pollution arising from the exploration and exploitation of the sea-bed
8. Date and place of next session
9. Other matters
10. Election of Chairman and Vice-chairman for the next intersessional period and for the ninth session
11. Consideration and approval of the Report of the session

ANNEX II

LIST OF DOCUMENTS

<u>No.</u>	<u>Agenda item</u>	<u>Author</u>	<u>Title</u>
GESAMP VIII/1	1	-	Agenda for the eighth session
"	VIII/2	IMCO	Evaluation of the hazards of harmful substances in the marine environment
"	VIII/2/1	Working Group	Evaluation of the hazards of harmful substances in the marine environment - Reports of the Working Group
"	VIII/2/1 Add.1	Drafting Group	Amendments to GESAMP VIII/2/1
"	VIII/3	WHO	Suggestions for the updating of the "Review of Harmful Substances"
"	VIII/4	Working Group	Working Group on the Impact of Oil on the Marine Environment - Report, Second Session
"	VIII/4/Add.1	<u>ad hoc</u> group	Part I: Problems, summary of observations and facts, findings
"	VIII/4/1	Working Group	The impact of oil on the marine environment. Part II. Resource document on impact of oil on the marine environment
"	VIII/4/2	Working Group	The impact of oil on the marine environment. Part III. Bibliography
"	VIII/5	WMO	Interchange of pollutants between the atmosphere and oceans
"	VIII/6	Working Group	Working Group on the Principles for Developing Coastal Water Quality Criteria. Report, Second Session
"	VIII/6/Add.1	<u>ad hoc</u> group	} Amendments to the report of the Working Group } on the Principles for Developing Coastal Water } Quality Criteria
"	VIII/6/Add.2	Drafting Group	
"	VIII/7	Working Group	The scientific aspects of pollution arising from the exploration and exploitation of the sea-bed. Report of the Working Group
"	VIII/7/Add.1	Drafting Group	Amendments to the report of the Working Group on Aspects of Pollution Arising from the Exploration and Exploitation of the Sea-bed
"	VIII/7/1	Working Group	Coastal area development (including special coastal zones)

<u>No.</u>	<u>Agenda item</u>	<u>Author</u>	<u>Title</u>
GESAMP VIII/7/2	7	Working Group	Petroleum and natural gas
" VIII/7/3		Working Group	Sand and gravel
" VIII/7/4		Working Group	Potential pollution from marine mining on the continental margin
" VIII/9/1	9	WHO	A zero discharge approach to marine releases
" VIII/9/2		FAO	Effects of thermal discharges to the environment
" VIII/Inf. 1		IMCO	Recent activities of IMCO in the field of marine pollution
" VIII/Inf. 2		FAO	Summary report of activities of FAO in the field of marine pollution
" VIII/Inf. 3		UNESCO	Report on the work of Unesco and its IOC in relation to marine pollution since the seventh session of GESAMP
" VIII/Inf. 4		WMO	Summary report on activities of WMO in the field of marine pollution
" VIII/Inf. 5		WHO	Summary of recent activities of WHO in the field of marine pollution
" VIII/Inf. 6		IAEA	Some of the IAEA activities related to marine environment during the past one year period
" VIII/Inf. 6/1		IAEA	Report on the International Workshop on Seabed Disposal of High-level Wastes, 16 - 20 February 1976, Woods Hole, Massachusetts, U.S.A.
" VIII/Inf. 7		UN	Recent activities of the UN in the field of ocean affairs
" VIII/Inf. 8		-	List of documents
" VIII/Inf. 9		-	List of participants

ANNEX III

LIST OF PARTICIPANTS

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ANNEX IV

THE IMPACT OF OIL ON THE MARINE
ENVIRONMENT

Content

- Part I: Summary
- Part II: Resource Document on Impact of Oil on the Marine Environment
- Part III: Bibliography, Impact of Petroleum Hydrocarbons on the Marine Environment

Part I

SUMMARY

Content

1. IMPLICATIONS OF OIL AND DISCHARGE SOURCES
2. FATES OF OIL - ROUTES AND PATHWAYS OF OIL EXPOSURE
3. ANALYTICAL TECHNOLOGY
4. CHEMICAL AND PHYSICAL EFFECTS OF OIL DISCHARGES
5. EFFECTS OF MARINE LIFE FORMS
6. HUMAN EFFECTS FROM OIL DISCHARGES

Part II

RESOURCE DOCUMENT ON IMPACT OF OIL
ON THE MARINE ENVIRONMENT

Content

- CHAPTER 1 IMPLICATIONS OF OIL AND DISCHARGE SOURCES
- 1.1 Descriptions of oil
 - 1.2 Oil types and significance to marine living resources
 - 1.3 Quantities of oil discharged into the marine system
 - 1.4 Rationale for classification of sources of oil pollution with respect to ecological damage
- CHAPTER 2 FATES OF OIL - ROUTES AND PATHWAYS OF OIL EXPOSURE
- 2.1 Physical, chemical and microbiological factors influencing the fate of oil
 - 2.1.1 Spreading
 - 2.1.2 Evaporation
 - 2.1.3 Solution
 - 2.1.4 Emulsification
 - 2.1.5 Effects of dispersants
 - 2.1.6 Sedimentation
 - 2.1.7 Oxidation
 - 2.1.8 Chemical degradation
 - 2.1.9 Biological fates (general)
 - 2.1.10 Microbial degradation
 - 2.1.11 Tar balls
 - 2.2 States of oil available for uptake
 - 2.2.1 Uptake mechanisms
 - 2.2.2 Storage, metabolism, discharge
 - 2.3 Biomagnification
- CHAPTER 3 ANALYTICAL TECHNOLOGY
- 3.1 Collection of samples
 - 3.2 Isolation and separation
 - 3.3 Chemical analysis
 - 3.4 Reporting analyses
 - 3.5 Comments
- CHAPTER 4 CHEMICAL AND PHYSICAL EFFECTS OF OIL DISCHARGES
- 4.1 Gas transfer and deoxygenation
 - 4.2 Heating effects
 - 4.3 Pollutant sorption
 - 4.4 Hydrocarbon interference with carbon dioxide transfer

CHAPTER 5 EFFECTS ON MARINE LIFE FORMS

- 5.1 Effects of oil on marine organisms
 - 5.1.1 Birds
 - 5.1.2 Mammals
 - 5.1.3 Fish
 - 5.1.4 Use of fisheries statistics to assess the effects on fish
 - 5.1.5 Turtle fisheries
 - 5.1.6 Benthic organisms
 - 5.1.7 Zooplankton
 - 5.1.8 Phytoplankton
 - 5.1.9 Macroscopic Algae
 - 5.1.10 Marine grasses
 - 5.1.11 Microscopic sea-weeds
 - 5.1.12 Other marine plants
- 5.2 Effects of oil on marine populations
 - 5.2.1 Birds
 - 5.2.2 Mammals
 - 5.2.3 Plankton
 - 5.2.4 Subtidal organisms
 - 5.2.5 Microbial populations
- 5.3 Effects of oil on the behaviour of marine organisms
- 5.4 Miscellaneous topics
 - 5.4.1 Bioassay methods of determining the toxicity of oils
 - 5.4.2 Effects of oil on early stages of growth of marine organisms
 - 5.4.3 Habitat alteration and destruction
 - 5.4.4 Effects of oil discharges on marine organisms in polluted waters

CHAPTER 6 HUMAN EFFECTS FROM OIL DISCHARGES

- 6.1 Carcinogenic
 - 6.1.1 Problem - General
 - 6.1.1.1 Occurrence in oils
 - 6.1.1.2 Levels of PNAH's in oils
 - 6.1.1.3 Levels in other products and wastes
 - 6.1.1.4 Relative contribution of oil-derived PNAH's
 - 6.1.1.5 Levels in marine produce and other foods
 - 6.1.1.6 Summary
 - 6.1.2 Problem 1: What is the increased health hazard to man from oil-derived PNAH's
 - 6.1.2.1 Bioaccumulation and biomagnification
 - 6.1.2.2 Correlation of oil-derived hydrocarbons with position in food chain
 - 6.1.2.3 Summary of evidence for accumulation or discharge of PNAH's
 - 6.1.3 Problem 2: Threshold dose and hazard to man of elevated PNAH contents
 - 6.1.4 Problem 3: Induction of carcinomas in marine produce
 - 6.1.4.1 Summary of cancer induction in marine produce
 - 6.1.5 Mutagenicity and teratogenicity
- 6.2 Loss of marine foods
 - 6.2.1 Definitions
 - 6.2.2 Problems
 - 6.2.3 Background
 - 6.2.4 Tainting
 - 6.2.5 Data
 - 6.2.6 Comments and conclusions

Part III

BIBLIOGRAPHY

IMPACT OF PETROLEUM HYDROCARBONS

ON THE MARINE ENVIRONMENT

Content

- I. ANALYTICAL
 - I.1 Methods of Taking Samples
 - I.2 Detection
 - I.3 Chromatography
 - I.4 Spectrophotometry
 - I.5 General
- II. EFFECTS
 - II.1 Plants and Plankton
 - II.2 Shellfish
 - II.3 Fish
 - II.4 Other Organisms
 - II.5 Carcinogens
 - II.6 Case Histories
 - II.7 Other Effects and Properties
- III. DISPERSANTS/DETERGENTS
- IV. BIODEGRADATION
- V. LEVELS OF HYDROCARBONS
- VI. NATURAL SEEPS/OFFSHORE OPERATIONS
- VII. OIL LUMPS IN THE SEA
- VIII. PROPERTIES OF OIL
- IX. GENERAL/DISCUSSIONS
- X. SYMPOSIA/CONFERENCES
- XI. SELECTED BIBLIOGRAPHIES

List of members of the Working Group on the Impact of Oil on
the Marine Environment and of experts assisting the group

The composition of the working group changed during the period of its work as some members, due to other commitments, had to resign and were substituted by other experts. Advice was also sought by the group from invited experts who prepared some working documents (see page 7: List of Working Papers).

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Dr. C.H. Thompson, Washington, D.C., U.S.A. (Chairman)
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Professor S. Genovese, Messina, Italy (2nd session)
Dr. C.S. Hegre, Narragansett, Rhode Island, U.S.A. (preliminary meeting)
Dr. P.G. Jeffery, Stevenage, U.K.
Dr. A.B. Jernelöv, Stockholm, Sweden (2nd session)
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Dr. J.D. Walker, University of Maryland, Maryland, U.S.A.
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List of Working Papers

First Session:

- R.A.A. Blackman: Carcinogens
R.R. Colwell and J.D. Walker: Impact of petroleum hydrocarbons
M.G. Ehrhardt: Oil into the sea - Routes into and within biosystems
P.G. Jeffery: Effect of oil pollution on oxygen transfer
E.M. Levy: The effects of oil on marine organisms
K.H. Palmork: Working paper on tainting
C.H. Thompson: Two bibliographies;
- (i) The effects of light refined oils or petroleum hydrocarbons on the marine environment, Annotated bibliography, September 1974
- (ii) The effects of light refined oils or petroleum hydrocarbons on the marine environment, Bibliography, October 1974

Second Session:

- R.A.A. Blackman: Human effects from oil discharges - 2. Health effects; Carcinogenic
R.R. Colwell and J.D. Walker: Microbial attack of oils
C. Cote and E.M. Levy: Routes and/or states of oil available to and in biological systems. (This paper amended and revised by J. Schwartz).
C.R. Gentry, Jr.: Combined bibliography on the impact of oil on the marine environment
P.G. Jeffery: Chemical and physical effects of oil discharges
A.B. Jernelöv: Rationale for classification of sources of oil pollution with respect to ecological damage
K.H. Palmork: Analytical technology status
K.H. Palmork: Human effects from oil discharges - Loss of marine food
E.M. Levy: Higher marine life forms - Lethal and sublethal effects from oil discharges
O.G. Mironov: Effects of oil pollution on marine organisms
R.G.J. Shelton and J. Nichols: Petroleum (including Natural Gas) - Paper prepared originally for the GESAMP Working Group on the Scientific Aspects of Pollution Arising from the Exploration and Exploitation of the Sea-bed
C.H. Thompson: Introduction, Working draft report, Bibliography
O. Zafiriou: Physical and chemical effects of oil in the marine environment (Draft outline)

ANNEX V

PRINCIPLES FOR DEVELOPING COASTAL WATER QUALITY CRITERIA

Content

1. INTRODUCTION
2. SUMMARY OF PRINCIPLES
 - 2.1 Principles related to goals
 - 2.2 Principles related to methodology
 - 2.3 Principles related to implementation
3. ECOSYSTEMS
 - 3.1 Impact of ecological considerations on the development of principles
 - 3.2 Application of criteria for the protection of ecosystems
4. HUMAN HEALTH
 - 4.1 Fish and shellfish
 - 4.2 Bathing waters
 - 4.3 Aesthetics
5. LIVING RESOURCES
 - 5.1 Fisheries
 - 5.2 Fishing activities
 - 5.3 Aquaculture
 - 5.4 Others, including wildlife
6. OTHER ASPECTS
 - 6.1 Desalination
 - 6.2 Food-processing water
 - 6.3 Extraction of chemicals from seawater
 - 6.4 Industrial-cooling water
7. SUGGESTED PROCEDURE FOR ESTABLISHING CRITERIA
8. EXAMPLES OF APPLYING PRINCIPLES
 - 8.1 DDT as an example
 - 8.1.1 Data base
 - 8.1.2 Examples of possible approaches to development of water quality criteria
 - 8.1.2.1 Application factors with acute toxicity data
 - 8.1.2.2 Bioaccumulation and adverse effects on birds
 - 8.1.2.3 Bioaccumulation in seafood
 - 8.1.3 Conclusions
 - 8.2 Amenities
9. RECOMMENDATIONS
10. REFERENCES

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List of working papers

(1st and 2nd sessions)

- | | |
|-----------------------------------|---|
| J.S. Alabaster | - The Development of Water Quality Criteria for Marine Fisheries |
| A.L. Downing | - Criteria for Protection of Amenities (I)
- Criteria for Protection of Amenities (II) |
| T.W. Duke and
D.J. Hansen | - Water Quality Criteria for PCB's and DDT in Coastal Waters |
| E.E. Geldreich | - Principles for Developing Criteria for Coastal Bathing Waters
- Guidelines to Microbiological Quality of Shellfish Waters |
| C.S. Hegre | - Plankton Ecology in Relation to Establishment of Coastal
Water Quality Criteria
- Water Quality Criteria for Protection of Coastal Marine
Ecosystems |
| S. Keckes | - Manual on Beach Sanitation (Guides and Criteria for
Recreational Quality of Beaches and Coastal Waters)
- Principles and Guidelines on Coastal Water Quality
Monitoring for Public Health Purposes |
| A. LaFontaine and
S. de Maeyer | - Quality Criteria of Marine Waters with Regard to Public
Aspects taking Lead as an Example |
| M. Waldichuk | - Coastal Water Criteria for Fishing Activities
- Coastal Water Quality Criteria for Protection of Living
Resources, Fishing, Amenities and other Uses against
Petroleum Hydrocarbons |

ANNEX VICOASTAL AREA DEVELOPMENT

(Some provisional considerations on coastal area development to be further evaluated by the Working Group on Marine Pollution Implications of Sea-bed Exploitation and Coastal Area Development)

1. Coastal area development should begin with decisions regarding the primary purposes (e.g. industry, ports and harbours, fishing, mining, tourism and recreation, conservation) for which particular areas are to be used based upon a careful survey and an assessment of the development potential. In this way, potential conflicts of interest (e.g. between tourism and industry, industry and fisheries, fisheries and oil exploitation) can be recognized and minimized by designation of primary uses for particular areas and appropriate regulations for the disposal of wastes of all kinds. In addition, certain activities may prove to be of benefit, despite temporary conflicts, when considered within a wider perspective or longer time frame.
2. Background information regarding meteorological conditions, water circulation, waves, sediment transport, tidal movements, as well as beach profiles and the nature of the bottom and biota near shore, should be collected and evaluated. This is needed to provide guidance on the siting of sewage and industrial waste outfalls, the effects of mining and dredging and the installation of coastal and offshore structures. An understanding of the physical processes is particularly important for estuaries because of their great development potential which tends to lead to severe conflicts of interest and possible environmental degradation.
3. When planning measures to prevent damage to living resources, an assessment of the fishery potential of the coastal waters (including suitability for aquaculture) should be made, and their importance in relation to the maintenance of offshore stocks of fish and shellfish (e.g. as nursery or spawning grounds) should be determined.
4. Because development of a coastal area goes together with increased population and greater quantities of sewage and other wastes, regulations for the disposal of wastes of all kinds should be firmly established at an early stage in order to prevent damage to living resources, risk to public health or reduction of amenities. The possibility of spreading water-borne disease through contamination of shellfish beds by sewage should be particularly borne in mind. This may be especially important where seasonal tourism may overload waste disposal services. Particular care is needed in the disposal of industrial wastes containing metallic residues or persistent and toxic organic substances which may accumulate in nearshore fish and shellfish to such an extent as to harm the stocks or render them unacceptable for human consumption. The effects likely to arise from the installation of power stations should be carefully considered.
5. The release of oil from terminals, refineries, port installations or industrial plants is particularly undesirable if serious loss of amenity value of beaches for tourism, and tainting of fish and shellfish are to be avoided.
6. The pollution level of rivers discharging at the coast and serving as waste disposal channels for inland settlements should be monitored and, where necessary, reduced by appropriate action at the source of the offending discharges.
7. Possible international repercussions of new coastal developments should be assessed at the planning stage and suitable adjustments made before development begins.
8. Coastal developments should be investigated not only for their possible local and direct disturbances of the marine environment and ecological equilibrium, but also for more distant and indirect consequences which could include the effects of persistent substances carried by currents, significant changes to nearshore currents and sediment transport, and interference with the life cycle of fish not caught in the immediate coastal area.

ANNEX VII
ASPECTS OF POLLUTION ARISING FROM EXPLORATION
AND EXPLOITATION OF THE SEA-BED

Content

1. INTRODUCTION
2. GENERAL CONSIDERATIONS OF EFFECTS OF SEA-BED EXPLORATION AND EXPLOITATION
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 - 2.2 Dredging and beach mining
 - 2.3 Underground mining
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3. DISPERSION OF THE FINE-GRAINED MATERIAL
4. POLLUTION ARISING FROM THE EXPLOITATION OF PETROLEUM AND NATURAL GAS
5. MANGANESE NODULES
6. SAND AND GRAVEL
7. PHOSPHORITE
8. OTHER MINERALS
 - 8.1 Resources
 - 8.2 Pollution potential
 - 8.3 Summary (table)
9. REFERENCES

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Aspects of Pollution Arising from the Exploration and
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List of working papers and annexes to
the Report of the Working Group
prepared at the 2nd and 3rd session

Working papers:

- G. Kullenberg: Dispersion of fine-grained material and
other physical aspects
- R.D. Gerard: Report on pollution arising from exploration
and exploitation of manganese nodules

Annexes:

- I: Coastal area development (including special coastal zones)
- II: Petroleum and natural gas
- III: Sand and gravel
- IV: Potential pollution from marine mining on the continental
margin



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