

10
1978

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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. 9

**Report of the Tenth Session
Paris, 29 May - 2 June 1978**



United Nations Educational, Scientific and Cultural Organization

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

REPORT OF THE TENTH SESSION

Paris, 29 May-2 June 1978

UNESCO, 1978

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

Report of the tenth session held at Unesco Headquarters, Paris, 29 May-2 June 1978. Rep. Stud. GESAMP (9).

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1. OPENING OF THE MEETING

1. The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) held its tenth session at Unesco Headquarters, Paris, from 29 May to 2 June 1978 under the Chairmanship of Dr. G. Kullenberg. Dr. H. Thompson was Vice-Chairman.
2. At the opening of the session, Dr. Michel Batisse, on behalf of the Director-General of Unesco, welcomed the experts and observers from other organizations to the session, and emphasized the importance of GESAMP as a multidisciplinary advisory body which brought a wide range of expertise to bear on problems put forward by the sponsoring organizations in relation to particular aspects of marine pollution which fell within the scope of their individual activities. The broad range of effects resulting from such disasters as the wreck of the "Amoco Cadiz" or which could result from other developments such as the growing traffic in spent nuclear fuel elements for reprocessing, amply demonstrated both the need for such a body as GESAMP and also the responsibility which the individual experts in the Group had to accept in dealing with the problems presented to them.
3. The agenda for the session as adopted by the Group is shown at Annex I. A list of the 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 shown at Annex II.
4. A list of participants including the experts, observers from interested organizations and representatives of the sponsoring organizations is shown at Annex III. The Group noted with regret that Dr. R. Chesselet, Dr. C.L. Osterberg, Dr. A.B. Jernelöv, Dr. J.M. de Silva and Dr. R. Gerard, who had been nominated as members of the Group, were unable to attend the session.

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

5. The Group noted that the Working Group on Evaluation of the Hazards of Harmful Substances Carried by Ships had held its sixth meeting in Delft from 9 to 13 May 1977 and its seventh meeting in London from 4 to 6 July 1977. A report covering both of these meetings (GESAMP-X/2) was introduced by the Chairman of the Working Group, Dr. P.G. Jeffery, who mentioned that the eighth meeting of the Group had also been held intersessionally (Bergen, 22-26 May 1978) but the report of that meeting would be submitted to the eleventh session of GESAMP.
6. It was noted that the Working Group, as requested by GESAMP at its ninth session, had given particular consideration to the definition of the term "bioaccumulation" and the mechanisms by which bioaccumulation can take place, e.g. directly from the water, via the food chain or even via a single food organism. It was suggested that terms, such as bioaccumulation, bioconcentration and biomagnification, which are variously used to describe these mechanisms should be clearly defined. After discussion, however, the Group agreed that while such definitions might be useful in some aspects of its work, they may have little application in the task of evaluating the bioaccumulation hazard. The Group concurred with the conclusion reached by the Working Group that, although the time-scale by which the various processes take place will necessarily differ, the end result as far as the target animal is concerned is the same. In the wider context of GESAMP's activities, it was felt that the subject invited further discussion (see agenda item 12).
7. The Group approved the hazard rating symbols as defined by the Working Group with the exception that the definition of the symbol "O" should be amended to read as follows:

"O Refers to a substance for which the evidence does not support a rating of +, T, Z or B".

8. It was noted that the Working Group intended to keep the problem of bio-accumulation under review bearing in mind the possibility of adopting a more detailed categorization which would also include consideration of compounds (such as simple halogenated hydrocarbons) hitherto regarded as man-made pollutants but which may also occur naturally in the environment. In this connection it was agreed that the third sentence of paragraph 7 of the Working Group report should be amended to read as follows:

"The Working Group was also aware that many compounds previously considered as man-made pollutants are also produced by a variety of natural processes and may therefore occur naturally in the environment (in particular, the Working Group had in mind recent work on simple halogenated hydrocarbons)".

9. It was noted that the Working Group was still facing difficulties in obtaining the necessary data, particularly with regard to toxicity to marine organisms, to enable the hazards of substances to be fully evaluated. While appreciating the action which had been taken by IMCO in this regard, the Group requested that organization to continue to encourage governments to commission the necessary research in order to provide the data required.

10. The Group noted and concurred with the view of the Working Group that a system should be introduced to facilitate the storage and retrieval of GESAMP Hazard Profiles.

11. In connection with paragraphs 9 and 10 above, the UNEP representative drew attention to the International Register of Potentially Toxic Chemicals (IRPTC) which had been established by UNEP at WHO Headquarters in Geneva. He suggested that the data already available in IRPTC could be useful to the Working Group and that IRPTC could be used for computerization of the Hazard Profiles developed by the Working Group. The Group recommended that, in the next intersessional period, the Chairman of the Working Group should explore these possibilities.

12. Subject to the foregoing comments and amendments, the Group approved the report of the Working Group including the Hazard Profiles of substances listed in section V and Annexes III and IV thereof, and requested the Working Group to continue its work on the evaluation of the hazards of harmful substances carried by the ships. It was further agreed that the study concerning the development of criteria for determining "harmlessness" of materials in Annex I of the London Dumping Convention (section VI and Annex V of the report) should be considered under item 4 of the agenda.

3. REVIEW OF POTENTIALLY HARMFUL SUBSTANCES

13. The increasing need for more uniformly available information on the potential hazards associated with certain substances was noted by many Member States of the co-sponsoring agencies. Such information had proved essential for the negotiation of a number of international and regional treaties on the protection of the marine environment from pollution. The Group was therefore invited by the Technical Secretaries to undertake a review of those substances which are of immediate relevance to presently prepared treaties.

14. The Chairman of the Working Group, Dr. B.H. Ketchum, recalled the results achieved at the Working Group meeting convened in connection with the ninth session of GESAMP, particularly the critical criteria for evaluation of hazardous

materials (GESAMP-IX, Annex IV). Also the previous Review of Harmful Substances (GESAMP Reports and Studies No. 2) was discussed and its updating considered.

15. A brief statement from the Working Group requested guidance from the Group on the following:

- (i) the philosophy and strategy of the review exercise;
- (ii) the terms of reference for an intersessional working group;
- (iii) the critical criteria for evaluation of hazardous materials (GESAMP-IX, Annex IV);
- (iv) a priority list of selected substances for consideration by the intersessional working group; and
- (v) the scope, structure and content of the review documents for selected substances.

16. With regard to item (iv) above, several substances were discussed which were considered potentially harmful to the marine environment. However, it was decided that the Group at the present session should not determine the priority list, but should ask the Working Group, in co-operation with the Technical Secretaries of the appropriate agencies, to develop such a priority list.

17. While substantive information on human health effects had become available recently through the WHO/UNEP Environmental Health Criteria Documents, a specific review of their marine aspects together with an assessment of harmful effects on the marine environment as well as on the adjacent coastal areas was felt necessary. In addition to the review of known effects, a qualifying evaluation of the potential harmfulness of each substance was considered a major task to be undertaken by the Group.

18. The Working Group, now entitled the Working Group on Review of Potentially Harmful Substances, was therefore re-established with the following terms of reference:

(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) 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.

19. The Working Group should pay particular attention to substances which are already of interest due to their inclusion in pollution prevention conventions, e.g. organo-silicon compounds, sewage, plastics and radio-active substances

(especially the transuranics). The Working Group may also prepare reviews on new materials which appear to merit attention because of their potential build-up in the marine environment. The Working Group should report on the need to update sections of the GESAMP Reports and Studies No. 2.

20. The present Chairman of the Working Group, Dr. Ketchum, was redesignated and Dr. Magos and Dr. Wilson, members of GESAMP, joined him. The Group will be jointly sponsored by IAEA, FAO, WHO, United Nations and UNEP, with WHO assuming a co-ordinating role in its activities.

4. SCIENTIFIC ASPECTS OF DEVELOPING CRITERIA FOR DETERMINING HARMLESSNESS OF MATERIALS LISTED IN ANNEX I OF THE LONDON DUMPING CONVENTION

21. As requested by the Group at its ninth session, the Working Group on Evaluation of the Hazards of Harmful Substances Carried by Ships, at its sixth and seventh sessions, considered the scientific aspects of the development of criteria for determining "harmlessness" of materials listed in Annex I to the London Dumping Convention. The report of the Group on this subject (GESAMP X/2, section VI and Annex V) was introduced by the Chairman of the Working Group, Dr. P.G. Jeffery.

22. It was noted that, as agreed at the ninth session of the Group, the findings of the Working Group had been transmitted to the Second Consultative Meeting to the London Dumping Convention (26-30 September 1977) together with certain amendments to the text which had been proposed by the Chairman of the Group, Dr. G. Kullenberg, and accepted by the Working Group (GESAMP X/4, paragraph 2). The Technical Secretary of IMCO described the action being taken by the Consultative Meeting and its Ad Hoc Scientific Group on Dumping in order to facilitate the implementation of paragraphs 8 and 9 of Annex I to the London Dumping Convention and the interpretation of the terms "harmlessness" and "trace contaminants". The Consultative Meeting had expressed its appreciation to the Group for the work involved in preparing the findings of the Working Group which were being taken into account in the further work on this subject.

23. In particular, it was noted that the Ad Hoc Scientific Group on Dumping had prepared draft Guidelines incorporating a procedure based on an assessment of the possible environmental impact of the proposed dumping. This assessment would include specified tests as well as consideration of the characteristics of the receiving area. The Guidelines also included provision for a consultation procedure in cases where doubts exist regarding the results of these tests. It was further noted that the Ad Hoc Scientific Group on Dumping will continue the development of the Guidelines at an intersessional meeting to be held from 26 to 30 June 1978. Particular consideration will be given to formulation of the proposed test procedures at that time. In the light of this information the Group considered the findings of the Working Group and expressed certain views and comments which may be taken into account by the Ad Hoc Scientific Group on Dumping.

24. Attention was called to the importance of adsorption and metal complexing, especially when combined with precipitation. While such processes may reduce the concentration of the pollutant in the water column, in some circumstances the material bound to the sediment could be more readily available to bottom living animals and hence give rise to an increased potential to cause harm. The extent to which this can occur is known to vary with both pollutant and environmental conditions. For this reason, more detailed studies, particularly on the extent to which such bound substances can be released and recycled, are needed before any definitive statements are made on harmlessness in this context.

25. Noting that there was a possibility that the Third Consultative Meeting may request further scientific advice from the Group regarding test procedures to be specified in the Guidelines, the Group expressed its readiness to respond. Nevertheless it was agreed that, in principle, any such advice prepared by GESAMP Working Groups should be approved by the Group in plenary before being passed to the Consultative Meeting. With this in mind, the Group agreed that, should a request be made as a result of the meeting of the Ad Hoc Scientific Group on Dumping, the Working Group on Evaluation of the Hazards of Harmful Substances Carried by Ships should undertake this task and submit a report to the eleventh session of GESAMP. However, it was noted that the membership of the Working Group would need to be adjusted in order to ensure that the necessary breadth of expertise is available.

5. INTERCHANGE OF POLLUTANTS BETWEEN THE ATMOSPHERE AND THE OCEANS

26. The interim report of the Working Group on Interchange of Pollutants between the Atmosphere and the Oceans was reviewed by the Working Group Chairman, Dr. W.D. Garrett. This report was prepared at an intersessional meeting held in Dubrovnik in October 1977. It was noted that an "Introductory Review of the State of Knowledge in the Field of Interchange of Pollutants Between the Atmosphere and the Oceans", one of the terms of reference, was annexed to the interim report. A list of background papers prepared by the Working Group members was also annexed, the contents of which had been partially incorporated into the report. Following a condensation of the Introductory Review of the State of Knowledge the report discussed the atmospheric life cycle of pollutants in the lower troposphere, exchange mechanisms and fluxes, transport modes toward the air-sea interface, and pollutant modification of physical and chemical processes at the air-sea interface.

27. The second intersessional meeting of this Working Group has been tentatively scheduled for September 1978 when the remaining terms of reference will be addressed. Comments of the tenth session of GESAMP will be accommodated through revision of and additions to the existing interim report.

28. Whilst the Group expressed general satisfaction with the work so far accomplished by the Working Group, some members expressed concern over points of detail and the fact that several of the statements made in the report and in Annex V needed revision. The Working Group Chairman agreed that this was the case and ensured that these, and any other comments sent to him by members of the Group would be considered at the Working Group's next meeting.

29. The Group felt that the criteria for the selection of substances of interest introduced by man should be more closely defined. It was suggested that the Working Group should consider including such substances as chlorine, asbestos, ozone, N₂O and other oxides of nitrogen in their future deliberations. The Working Group should attempt to include in future reports estimates of air-sea interfacial fluxes for substances of interest, e.g. in connection with the Working Group on the Review of Potentially Harmful Substances. The rates of tropospheric photo-oxidation for these substances should also be estimated where possible.

30. There was a discussion of the air-sea exchange of petroleum and of its impact on the properties of the ocean-atmosphere boundary. In this regard it was noted that data from the IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) has been processed, and a recent data analysis has been made to determine the quantity of petroleum on the sea surface and the areal surface coverage by oil at any particular time. Information of this kind will assist in the determination of the impact of oil films on air-sea interfacial properties and exchange processes. With regard to this subject, it was mentioned that in relatively calm marine

conditions, it is often difficult to distinguish between oil films and natural slicks. To avoid such ambiguities in the visual observations for sea-surface oil, it was noted that the Revised Operational Plan for IGOSS Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), as well as the plan for Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters - of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL), includes a set of guidelines for distinguishing between oil films and other sea surface effects, e.g. natural slicks or zones of calm. These instructions were prepared by the IOC/WMO subgroup of experts on MAPMOPP in April 1976.

31. The possibility that pathogenic micro-organisms are transported from sea to land via the atmosphere was raised.

6. MARINE POLLUTION IMPLICATIONS OF SEABED EXPLOITATION AND COASTAL AREA DEVELOPMENT

32. The Chairman of the Working Group, Dr. Cole, introduced the report which he characterized as an interim report resulting from two intersessional meetings. The first meeting was 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.

33. The terms of reference of the Working Group as given at the eighth session of GESAMP were reviewed. It was noted that the first task dealt with certain aspects of seabed exploitation which had been examined at the ninth session of GESAMP and been approved for inclusion in the subsequently published GESAMP Reports and Studies No. 7. The second task, "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", was the subject of the present report.

34. The Working Group Chairman drew attention to the need for considerable editing and streamlining of the interim report. He noted also that a few aspects had not been covered in sufficient detail, especially human health. The extensive discussion which followed, praised the report for its potentially valuable contribution in assisting developing countries to develop and manage their coastal resources. It was felt, however, that major efforts were required in editing to achieve a more uniform level of presentation, appropriate to its intended audience.

35. The matrices presented in the report were discussed and the Group suggested that additional explanatory material was required. Although the need for greater economy in presentation was expressed, it was stressed that this should not be done at the expense of clarity.

36. Certain experts pointed out the need for further examination of geological factors in coastal areas. The possible need to introduce a discussion of remedial measures in certain coastal areas was also mentioned as was the need for greater emphasis on information dissemination.

37. It was agreed that additional, more detailed comments and suggestions would be forwarded to the Chairman of the Working Group in written form so that they could be fully taken into account. The material on waste treatment would be examined by the Chairman of the Working Group on the Scientific Aspects of Removal of Harmful Substances from Waste Water and it was noted that the substantive treatment of this subject would take place in that Working Group.

38. The Group recommended the report as the basis for a document which would provide necessary guidelines for scientists and others involved in coastal area development and resource management in developing countries. The need for adequate citations and references was repeated and the suggestion that an annotated bibliography be prepared was accepted.

39. The Group agreed that the Working Group should meet during the intersessional period for the purpose of finalizing the report in order to present it to GESAMP at its eleventh session for approval.

7. SCIENTIFIC ASPECTS OF THE REMOVAL OF HARMFUL SUBSTANCES FROM WASTE WATER

40. Scientific advice on the environmentally sound use of technology for waste handling and disposal into marine waters was recognized as being a major need of many Member States of the co-sponsoring agencies. Such needs were already brought to the attention at the ninth session of GESAMP and reiterated at the present session.

41. Proposed terms of reference containing two tasks were submitted for consideration by the Group:

- (i) to update, revise and complete the document on Management of Waste Disposal (GESAMP-IV/19, Annex VI); and
- (ii) to evaluate alternative methods for the control of the release into the marine environment of potentially harmful substances.

The Chairman of the Working Group, Dr. Thompson, provided relevant discussion papers, one containing updating comments on the existing document and one elaborating on the removal of selected harmful substances from waste water.

42. A discussion developed on the scope and extent of scientific advice from GESAMP on waste handling and disposal problems. Such advice was generally considered as a legitimate task of GESAMP as far as the scientific aspects are concerned. Consequently, the narrow focus on waste water treatment has to be broadened and other relevant aspects should be included, particularly the resulting impact of the coastal water quality and ecosystems.

43. The Group supported the proposal to form a working group to update the document on Management of Waste Disposal (GESAMP-IV/19, Annex VI) and requested the Working Group to submit a revised version to the eleventh session of GESAMP. Subsequent publication in the series GESAMP Reports and Studies is envisaged.

44. The second proposal concerned evaluation of control options for selected harmful substances, was seen to be related to the review of potentially harmful substances (see agenda item 3) and would follow as a logical task after the respective review documents have been prepared. Accordingly, its implementation was deferred until first results became available from the review exercise, hopefully at the next session of the Group.

45. With reference to the implementation of Article IX (c) of the London Dumping Convention, the Group took note of the recommendation made by the Second Consultative Meeting of Contracting Parties to that Convention (London, 26-30 September 1977) that experts and specialists in dumping should be included in the Working Group which may be formed by GESAMP on the control of harmful substances released into marine environment.

46. The Group therefore agreed that the Working Group on the Scientific Aspects of the Removal of Harmful Substances from Waste Water should continue its task with the above terms of reference (paragraph 41). The Chairman, Dr. Thompson, and Dr. El-Sharkawi, as members of GESAMP, will be assisted by appropriate outside experts. The Working Group will be jointly sponsored by WHO, FAO and UNEP, with WHO acting as the lead agency.

8. BIOLOGICAL EFFECTS OF THERMAL DISCHARGES IN THE MARINE ENVIRONMENT

47. The Working Group on the "Biological Effects of Thermal Discharges in the Marine Environment" reported through the Chairman, Dr. V. Pravdic that some limited progress had been made. No intersessional meeting of this Working Group had been held. From a discussion of the Working Group's report, the following was noted:

- (i) no convincing body of data had been identified to prove that thermal discharges had other than local harmful effects on living marine resources due to increased temperature alone;
- (ii) changes in the physical properties of marine waters, e.g. salinity, density, viscosity, are reversible and limited to the localized area of the thermal discharge plume;
- (iii) entrainment and entrapment, while recognized as having effects on living marine resources at specific cooling sites, have not been shown to have any measurable global impact;
- (iv) synergistic and antagonistic actions have been reported for thermal and associated chemical discharges. For example, several enzyme reactions including those which act on foreign compounds have different temperature optima. The induction and inhibition of these enzymes by foreign compounds are also likely to be temperature dependent. Therefore, uptake, accumulation and metabolism of certain pollutants might be significantly altered;
- (v) detailed studies in various climatic regions and hydrodynamic regimes are needed to assay the direct effects of thermal discharges compared to those due to natural variation in temperature;
- (vi) both beneficial and detrimental ecosystem changes have been observed in the vicinity of thermal discharge plumes; examples mentioned included local changes in benthic communities, changes in distribution of boring animals and parasites, local improvement in oyster fisheries. Conditions may be provided which could prove to be favourable for aquaculture in temperate zones;
- (vii) localized biological effects were recognized as being caused by the practice of chlorination (with the subsequent release of bromine) or use of other biocides on the influent cooling waters thereby producing thermal effluents containing potentially biological harmful substances.

48. On the basis of extensive discussion, the Group confirmed that the biological effects of thermal discharges only locally affect living marine resources. However, the number and size of cooling water systems which it is expected will be constructed in the near future in association with power, desalination, and other manufacturing plants, can stimulate common global concerns for thermal discharge effects on living resources. Contemporary developmental work on more efficient

energy production and heat exchangers may provide some relief to this anticipated problem. The Group concluded that the present level of information available to it was so diffuse that no further significant contribution could be made. Therefore, the Group recommended that FAO, as the agency concerned, provide a comprehensive review of information available for the next session of GESAMP. The Group agreed to suspend action on this subject until such a step has been taken. It was noted by the Group that, during the next intersessional period, a report may be made available from the International Hydrological Programme Working Group on the Effects of Once-Through Power Plant Cooling on Aquatic Systems, which pertains primarily to fresh water systems. This report, in addition to the information which may be made available by FAO, will also serve as the basis of discussion at the eleventh session of GESAMP.

9. MONITORING BIOLOGICAL VARIABLES RELATED TO MARINE POLLUTION

49. The report of the Working Group on the Monitoring of Biological Variables related to Marine Pollution (established at the ninth session of GESAMP) was presented by the Chairman, Dr. A.D. McIntyre. The Working Group met in Aberdeen (15-16 December 1977) and in Paris (26-27 May 1978), and had expanded its membership to include two outside experts, so as to cover important areas of expertise. The Chairman of the Working Group emphasized the interim nature of the report.

50. The Working Group had decided first to examine carefully its terms of reference to ensure that there was no duplication of earlier activities or significant overlap with ongoing or planned work elsewhere. This evaluation convinced the Working Group that GESAMP could make a new and useful contribution in the defined field. The Working Group had proposed principles for the selection of biological variables to be used in the monitoring of pollution, and discussed the important intrinsic and extrinsic criteria. In its report, the Working Group drew attention to how these principles could be applied in practice to existing monitoring programmes and gave two examples. First, the application of quantitative indicators (physiological, cytological and biochemical indices) of the health of the organism and of its population in mussel watch programmes; and second, the use of easily detectable effects, such as skeletal deformities, in a general fish survey. The Chairman of the Working Group drew attention to the fact that while there were many good ideas in the defined field, few of these had been followed up. The Working Group stated their firm intention to seek proposals that could be put into action without delay.

51. During the discussion that followed, views both for and against continuation of the work were expressed. The Technical Secretary of WMO expressed interest in the work, especially in the context of their Integrated Monitoring Systems. The Technical Secretary of FAO also expressed interest and hoped to be present at the next meeting. He further stressed the necessity to consider the effects on living resources on a global scale and this was endorsed by several experts, many of whom emphasized that due consideration should be given to tropical areas. In this respect the Chairman of the Working Group pointed out that one of the additional experts was selected because of his substantial experience with tropical and open sea fisheries.

52. The attention of the Group was drawn to three items (two of which had not been referred to in the report) important to the final recommendations of the Working Group:

- (i) the report of the GESAMP Working Group, chaired by Dr. E. Goldberg, 1974 (Reports and Studies No. 1, Annex VII);

- (ii) the meeting of the Royal Society of London (24-25 May 1978) on the assessment of pollution effects; and
- (iii) the forthcoming ICES Workshop on Monitoring Biological Effects (Spring, 1979).

Some doubt was expressed on the feasibility of carrying out any meaningful biological monitoring at this time because of the logistic and technical problems of sampling and the difficulties in recognizing the significance or identifying the cause of observed changes in biological variables. It was stated, however, that the recent Royal Society Meeting referred to above produced encouraging suggestions that some techniques were now available for immediate use, and that considerable advance had recently been made in relevant scientific knowledge. The Working Group had independently reached this conclusion also.

53. Several potential variables were brought to the attention of the Working Group to consider, including monitoring for changes in primary production gross rate of respiration of benthic population, diversity indices, fecundity, density and migration patterns. The Chairman of the Working Group noted these points and agreed to include any not already considered. However, some reservations were expressed on the ease of introducing observations of biological variables into existing monitoring programmes; the amount of additional work involved should not be underestimated.

54. Some members drew attention to sections of the report which required clarification and to the apparent contradictions in some of the criteria proposed for selecting variables. In reply it was pointed out that the criteria were not intended to be mutually exclusive and should be considered together, but clarification of these aspects would be undertaken.

55. The consensus of GESAMP was that the Working Group should finish its work on the lines indicated in its interim report, paying special attention to the long- and short-term effects of living resources of inshore and open ocean areas. The Working Group should meet again as soon as possible after the ICES Workshop on Monitoring Biological Effects. In this connection, it was noted that two Working Group members would be attending the Workshop.

10. OTHER MATTERS

10.1 Protection of particularly sensitive sea areas

56. The Group took note of resolution 9 (Protection of particularly sensitive sea areas) adopted by the International Conference on Tanker Safety and Pollution Prevention (London, 6-17 February 1978). With reference to this resolution GESAMP was requested to provide scientific advice to assist IMCO in making an inventory of sensitive sea areas and in assessing the extent and type of protective measures that might be required in the field of prevention and control of marine pollution from ships and dumping of wastes.

57. During the discussion it was pointed out that the degree of contamination which a particular area could accept would depend on many factors such as coastline structure, seabed morphology, current and water exchange patterns, climatic conditions, biological productivity, the use made of the area and the particular properties of the individual contaminants concerned. Moreover, sensitivity could be assessed in terms of several different approaches such as the level of fisheries production, importance of amenity considerations or special characteristics (such as exist, for example, in the Arctic and Antarctic), each of which could lead to different results.

Nevertheless, it was generally agreed that in identifying such areas, it would be necessary to estimate the degree of stress from potential pollution taking account of the above-mentioned factors in relation to other considerations such as:

- (a) shipping density in the area;
- (b) use of the area for special purposes such as fish culture; and
- (c) location and type of industry in the area.

58. The Group noted that certain enclosed or semi-enclosed seas had been identified as "Special Areas" in the 1973 International Convention for the Prevention of Pollution from Ships. Considerable work had also been carried out at global, regional and national levels under the auspices of IOC, UNEP, other organizations and national programmes which could be useful to IMCO in this task.

59. In the light of the above discussion, the Group agreed that it would not be appropriate for GESAMP to prepare an inventory of geographical areas to be identified as particularly sensitive areas, but scientific advice could be provided to IMCO in the form of:

- (i) further development of the above guidelines for identifying particularly sensitive sea areas including the factors to be taken into account in such identification;
- (ii) the compilation of a bibliography of available material.

60. It was noted that the Marine Environment Protection Committee and the Consultative Meeting of Contracting Parties to the London Dumping Convention at their next meetings, during the latter half of 1978, will consider the implementation of resolution 9 of the Conference. The Group requested the IMCO Technical Secretary to bring its views and conclusions to the attention of these bodies, inviting them to indicate whether they concur with this approach. The Group agreed to consider the matter further at its next session.

10.2 Unesco proposal to establish a GESAMP Working Group on Continuing Review on the Health of the Oceans

61. The Group had before it a proposal from Unesco for the establishment of a Working Group to carry out a continuing review on the state of health of the oceans. The Technical Secretary of Unesco introduced the proposal and stressed the role of a proposed Working Group based upon recommendations from the ICSPRO agencies and the IOC Working Committee for GIPME as well as resolution X.7 of the IOC Assembly. He also pointed out that on the initiative of the Technical Secretary of UNEP, the proposal to make a permanent review of the state of the marine environment within the activities of GESAMP was discussed at the GESAMP Intersecretariat Meeting. The Group was informed by the Technical Secretary of UNEP that the undertaking of this task by GESAMP was appropriate under paragraph 2 (b) of its Updated Memorandum (which reads "to prepare periodic reviews of the state of the marine environment as regards marine pollution and to identify problem areas requiring special attention").

62. There was general acknowledgement of the importance of a critical and ongoing evaluation of the health of the oceans. Some of the experts expressed hesitation, however, concerning the suitability of such a task for GESAMP. It was agreed that the handling, analysis and assimilation of the most up-to-date data available would be essential; it would be a very large task which would require special assistance from the sponsoring agencies. The attention of the Group was drawn to a

WHO programme of similar character on world-wide epidemiological diseases, a programme that employs a full-time secretariat.

63. The contribution that could be made by organizations dealing with these matters on a regional basis was acknowledged, although pertinent documentation only exists for some areas, e.g. parts of the ICES area.

64. After the meeting of a small Ad Hoc Group, and on the basis of its recommendations, the Group agreed to undertake the task and to establish a Working Group as proposed by Unesco.

65. It was agreed that the Working Group would have the following objectives: to provide a periodically updated review of the state of pollution of the world's oceans; of the global mass balance of marine pollutants; on the trends of changes attributed to the level of pollution and on the effects of these changes on ocean-related natural processes (e.g. climate) and living resources, amenities and other legitimate uses of the marine environment, as well as on the land directly influenced by the oceans.

66. The Working Group should have 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.

67. According to the above terms of reference, the Working Group will be expected to meet in the intersessional period to discuss the availability of source material and to define which substances and areas will be covered in the first report. In the first intersessional period the Working Group should decide on pollutants that should be studied and prepare a detailed framework for the first report which should describe the proposed coverage, layout, approximate length and main source materials. This detailed framework should be available for discussion and approval at the eleventh session of GESAMP.

68. Subsequently the Working Group will be expected to prepare, as soon as practicable, the first report. If necessary, a consultant or consultants could be employed, either to draft the entire report according to the detailed framework agreed by GESAMP, or to prepare sections which cannot be adequately considered by the members of the Working Group.

10.3 IAEA Definitions and Recommendations in relation to the London Dumping Convention

69. The IAEA Technical Secretary informed the Group of recent activities of IAEA directed towards the revision of the Agency's Provisional Definition and Recommendations for the purposes of the London Dumping Convention (GOV/1889). Several consultant and advisory group meetings had established a firmer scientific base which had allowed the setting of conservative release rate limits by which various radionuclides could be released into the ocean at a single site. These revised release rate limits are approximately one order of magnitude lower (more restrictive) for

long-lived alpha-emitters, while for beta/gamma emitters comparable release rate limits are recommended. In order to follow the procedures established under Annex I, paragraph 6, of the London Dumping Convention (INFCIRC/205), an upper limit to the mass dumping rate of 10^5 tons per year was assumed and this considerably reduces the specific activity release rates.

70. Many other restrictions have further strengthened the revised Definitions and Recommendations, such as:

- (a) a strong emphasis on compliance with recommendations of ICRP;
- (b) a policy of isolation and containment of these wastes from the environment;
- (c) the prohibition of dumping of unpackaged liquid wastes into the deep ocean and the requirement that unpackaged solid wastes may only be dumped in a form that would reach the ocean bed intact;
- (d) stricter criteria on disposal site selection; and
- (e) clarification of the duties and status of the escorting officer.

71. The Group welcomed the written and verbal report by Dr. Forster and made the following observations. IAEA should be congratulated for its thoroughness in preparing a revised Definition and Recommendation for the London Dumping Convention (Annex I, paragraph 6). The Group could not at present express views on the scientific content of the document, as the full details of the proposed revision were not available for examination at the time of the discussion.

72. The Group noted that under the terms of paragraph 6 of Annex I of the London Dumping Convention, the responsibility for defining high-level radioactive waste or other high-level radioactive matter lay clearly with IAEA. Nevertheless, the Group expressed its readiness to consider specific multidisciplinary questions upon which IAEA might request advice in this regard and also with regard to the recommendations for dumping other radioactive wastes and radioactive matter called for in paragraph D of Annex II of the Convention.

73. The Group considered that there was much to be gained from the experience of IAEA and that the approaches followed in the field of radioactivity would be equally applicable to the field of non-radioactive pollution and would welcome the greater involvement of the Group in certain of IAEA's activities.

10.4 Technical assistance in relation to the London Dumping Convention

74. The Group noted that the Third Consultative Meeting of Contracting Parties to the London Dumping Convention to be held in October 1978 would give further consideration to the compilation of:

- (a) a list of experts who might be available to provide technical assistance to parties which request it; and
- (b) a bibliography of reports, publications and other documents containing data and information relating to pollution by dumping.

75. Recalling that, at its ninth session, GESAMP had agreed to assist IMCO on these matters, the Group invited its members to provide the IMCO Secretariat with any appropriate references or names and addresses of possible experts by 1 September 1978 so that they can be brought to the attention of the Consultative Meeting.

76. In this connection, however, the Group noted that, while it was possible to identify experts in the various disciplines required for dealing with dumping problems, it would be difficult to identify individual experts who could cover all these aspects. With this in mind the Group felt that there may be some advantage in also identifying certain technical societies and institutions whose membership would include scientists with experience in dealing with dumping questions.

10.5 Definitions

77. GESAMP noted that the terms bioaccumulation, bioconcentration and biomagnification are variously and indiscriminately used to describe the overall results of a number of biological processes in which substances are transferred to marine species and to human beings, and concluded that for its own purposes there was a need to ensure standard usage of these terms. Accordingly the Group defined them as follows:

bioconcentration is the extent to which the concentration of a particular substance is greater in an organism than in the water or in its food. The distribution will generally be non-uniform within the organism;

biomagnification is defined as the progressive accumulation of a substance via the food chain. It may be real or apparent;

bioaccumulation is a commonly used term which embraces both these definitions.

78. It should be emphasized that these terms describe the situation without reference to the biological, chemical or physical processes by which they take place.

11. FUTURE WORK PROGRAMME

79. The Group noted that intersessional work would continue or be initiated by working groups on the following subjects, with the indication of the sponsoring organization responsible for organizing the intersessional work, the Chairman and the members of the Working Groups within GESAMP:

- (i) Evaluation of the hazards of harmful substances carried by ships, which may include a possible additional task relating to the London Dumping Convention:

Sponsoring organization: IMCO
Chairman: Dr. Portman
Members: Dr. Bengtsson
Dr. Thompson

- (ii) Review of potentially harmful substances:

Sponsoring organizations: WHO in co-operation with FAO, IAEA, United Nations, UNEP
Chairman: Dr. Ketchum
Members: Dr. Magos
Dr. Wilson

- (iii) Interchange of pollutants between the atmosphere and the oceans:
- Sponsoring organizations: WMO in co-operation with UNEP
- Chairman: Dr. Garrett
- Members: Dr. Pravdic
Dr. Smagin
- (iv) Marine pollution implications of coastal area development:
- Sponsoring organizations: United Nations in co-operation with FAO,
WHO, UNEP
- Chairman: Dr. Cole
- Members: Dr. El-Sharkawi
Dr. Gerard
Dr. Kullenberg
- (v) Scientific aspects of removal of harmful substances from waste water:
- Sponsoring organizations: WHO in co-operation with FAO
- Chairman: Dr. Thompson
- Members: Dr. El-Sharkawi
Dr. Jernelöv
- (vi) Monitoring of biological variables related to marine pollution:
- Sponsoring organizations: Unesco in co-operation with FAO
- Chairman: Dr. McIntyre
- Members: Dr. Bengtsson
Dr. Wilson
Dr. Ramachandran
- (vii) Reviewing on the health of the ocean:
- Sponsoring organizations: Unesco in co-operation with all other
GESAMP sponsors
- Chairman: Dr. Kullenberg
- Members: Dr. Jernelöv
Dr. Pravdic
Dr. Smagin
Dr. Garrett

80. Members of the working groups from outside GESAMP will be nominated by the relevant sponsoring organization in consultation with the Chairman of GESAMP and the working group concerned.

12. DATE AND PLACE OF THE NEXT SESSION

81. The Group noted that WMO expected to host the eleventh session of GESAMP, possibly in September 1979. These arrangements will be confirmed and the exact dates of the session will be decided later.

13. ELECTION OF CHAIRMAN AND VICE-CHAIRMAN FOR THE NEXT INTERSESSIONAL PERIOD AND FOR THE ELEVENTH SESSION

82. The Group unanimously elected Dr. V. Pravdic as Chairman and Dr. A.D. McIntyre as Vice-Chairman for the next intersessional period and for the eleventh session of GESAMP. In taking this decision, the Group thanked the retiring Chairman, Dr. G. Kullenberg, and Vice-Chairman, Dr. H. Thompson, for their untiring leadership during their three years in office.

14. CONSIDERATION AND APPROVAL OF THE REPORT

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

ANNEX I

AGENDA

Opening of the meeting

1. Adoption of the agenda
2. Evaluation of the hazards of harmful substances carried by ships
3. Review of potentially harmful substances
4. Scientific aspects of developing criteria for determining harmlessness of materials contained in Annex I of the London Dumping Convention
5. Interchange of pollutants between the atmosphere and the oceans
6. Marine pollution implications of seabed exploitation and coastal area development
7. Scientific aspects of removal of harmful substances from waste water
8. Biological effects of thermal discharges on the marine environment
9. Monitoring biological variables related to marine pollution
10. Other matters
11. Future work programme
12. Date and place of next session
13. Election of Chairman and Vice-Chairman for the next intersessional period and for the eleventh session
14. Consideration and approval of the report of the session

ANNEX II

LIST OF DOCUMENTS

<u>NO.</u>	<u>AGENDA ITEM</u>	<u>AGENCY</u>	<u>TITLE</u>
GESAMP/X	1	-	Agenda for the tenth session
GESAMP X/2	2	IMCO	Evaluation of the hazards and harmful substances carried by ships
GESAMP X/2/Add.1	2	IMCO	Evaluation of the hazards of harmful substances carried by ships Note by the Technical Secretary of IMCO
EHE/EHC/78.9 VBC/TOX/78.21	3	WHO	Environmental health criteria for DDT and its derivatives
CEP/77.9	3	WHO	WHO coastal water quality programme
-	3	WHO	Status of the EHCP at 15 March 1978
-	3	WHO/UNEP	Environmental health criteria 1 Mercury
-	3	WHO/UNEP	Environmental health criteria 2 Polychlorinated biphenyls and terphen
-	3	WHO/UNEP	Environmental health criteria 3 Lead
-	3	IOC	Proposal of the GIPME Task Team on Marine Pollution Monitoring to GESAMP
GESAMP X/4	4	IMCO	Scientific aspects of developing criteria for determining harmlessness of materials contained in Annex I of the London Dumping Convention
GESAMP X/5	5	WMO	Interim report of the Working Group on Interchange of Pollutants between the Atmosphere and Oceans
GESAMP X/6	6	UN	Report of the Working Group on Marine Pollution Implications of Seabed Exploitation and Coastal Area Development
GESAMP X/7	7	WHO	Updating comments on GESAMP IV/19 Annex VI, Management of waste disposal

<u>NO.</u>	<u>AGENDA ITEM</u>	<u>AGENCY</u>	<u>TITLE</u>
GESAMP X/7/1	7	WHO	Scientific aspects of the removal of harmful substances from waste water
GESAMP X/8	8	FAO	Report of the Working Group on the Biological Effects of Thermal Discharge in the Marine Environment
IHP/II/WG 6.2/Rep.3	8	UNESCO	International Hydrological Programme Working Group on the Effects of Once-through Power Plant Cooling on Aquatic Systems
GESAMP X/9	9	UNESCO	GESAMP Working Group on the Monitoring of Biological Variables Related to Marine Pollution Interim report to tenth session of GESAMP
GESAMP X/10	10	IMCO	Protection of particularly sensitive sea areas
GESAMP X/12	10	UNESCO	A proposal to GESAMP by Unesco, on behalf of the IOC, to form an inter-sessional Working Group to Review the State of Health of the Oceans
GESAMP X/INF-IAEA	10	IAEA	Report on the work of IAEA on the revision of the agency's provisional Definition and Recommendation in connection with the London Dumping Convention
GESAMP X/INF.1	-	IMCO	Recent activities of IMCO in the field of marine pollution
GESAMP X/INF.2	-	FAO	Summary report of activities of FAO in the field of marine pollution
GESAMP X/INF.3	-	UNESCO	Report on the work of Unesco and its IOC in relation to marine pollution since the ninth session of GESAMP
GESAMP X/INF.7	-	UN	Recent activities of the United Nations in marine affairs

ANNEX III

LIST OF PARTICIPANTS

Members of GESAMP

Dr. Bengt-Erik Bengtsson
National Swedish Environment
Protection Board
Brackish Water Toxicology Laboratory
Studsvik
A-611 01 Nyköping, Sweden

Dr. H.A. Cole
Forde House
Moor Lane
Hardington Mandeville
Yeovil BA229 9NW
United Kingdom

Dr. F. El-Sharkawi
High Institute of Public Health
Alexandria University
Alexandria
Arab Republic of Egypt

Dr. William D. Garrett
Ocean Sciences Division, Code 8330
Naval Research Laboratory
Washington, D.C. 20375
United States of America

Dr. P.G. Jeffery
Deputy Director (Resources)
Warren Spring Laboratory
Gunnels Wood Road
Stevenage, Herts.
United Kingdom

Dr. Bostwick H. Ketchum
Woods Hole Oceanographic Institution
Woods Hole
Massachusetts 02543
United States of America

Dr. G. Kullenberg (Chairman)
Institute of Oceanography
Göteborg University
Stigbergstorget 8, Box 4038
400 40 Göteborg
Sweden

Dr. A.D. McIntyre
Marine Laboratory
P.O. Box 101
Victoria Road
Aberdeen AB9 8DB
United Kingdom

Dr. L. Magos
MRC Toxicology Unit
Carshalton, Surrey
United Kingdom

Dr. J.E. Portmann
Ministry of Agriculture, Fisheries
and Food
Fisheries Laboratory
Remembrance Avenue
Burnham-on-Crouch
Essex CM0 8HA
United Kingdom

Dr. V. Pravdič
Center for Marine Research
"Rudjer Bošković" Institute
P.O. Box 1016
41001 Zagreb
Yugoslavia

Professor C.P. Ramachandran
School of Biological Sciences
Universiti Sains Malaysia
Penang
Malaysia

Dr. V. Smagin
Arctic and Antarctic Research Institute
192104 Fontanka
34 Leningrad
USSR

Dr. C.H. Thompson
Manager, Office of Hazardous Materials
Battelle Memorial Institute
Pacific Northwest Division
2030 M Street N.W.
Washington, D.C. 20036
United States of America

Dr. K.W. Wilson
North West Water Authority (Rivers
Division)
New Town House
Warrington WA5 3CW
United Kingdom

Staff and representatives of the United Nations
and Specialized Agencies

Inter-Governmental Maritime
Consultative Organization (IMCO)

Mr. Y. Sasamura (Administrative
Secretary of GESAMP)
Director, Marine Environment Division
Inter-Governmental Maritime
Consultative Organization
101-104 Piccadilly
London W1V OAE
United Kingdom

Mr. S.L.D. Young (Technical Secretary
of GESAMP)
Deputy Director, Marine Environment
Division
Inter-Governmental Maritime
Consultative Organization
101-104 Piccadilly
London W1V OAE
United Kingdom

Food and Agriculture Organization
of the United Nations (FAO)

Dr. H.C.F. Naeve (Technical Secretary
of GESAMP)
Fishery Resources Officer
Fishery Resources and Environment
Division
Food and Agriculture Organization
of the United Nations
Via delle Terme di Caracalla
Rome
Italy

United Nations Educational, Scientific
and Cultural Organization (Unesco)

Dr. W. Slaczka (Technical Secretary of
GESAMP)
United Nations Educational, Scientific
and Cultural Organization
7 place de Fontenoy
Paris, France

World Meteorological Organization (WMO)

Dr. I. Zrajevskij (Technical Secretary
of GESAMP)
World Meteorological Organization
Case postale 5
CH-1211 Geneva 27
Switzerland

World Health Organization (WHO)

Dr. R. Helmer (Technical Secretary
of GESAMP)
World Health Organization
Avenue Appia
CH-1211 Geneva 27
Switzerland

International Atomic Energy Agency (IAEA)

Dr. Wm. O. Forster (Technical
Secretary of GESAMP)
Waste Management Section
International Atomic Energy Agency
P.O. Box 645
1011 Vienna, Austria

United Nations (UN)

Dr. L. Neuman (Technical Secretary
of GESAMP)
Office for Ocean Economics and
Technology
Department of Economic and Social
Affairs
United Nations
New York, N.Y. 10017
United States of America

United Nations Environmental
Programme (UNEP)

Dr. S. Keckes (Technical Secretary
of GESAMP)
Geneva Liaison Office
United Nations Environmental Programme
Palais des Nations
CH-1211 Geneva 10
Switzerland

Observers from international organizations

Intergovernmental Oceanographic
Commission (IOC)

Dr. R.C. Griffiths
Intergovernmental Oceanographic
Commission
Unesco
7 place de Fontenoy
75700 Paris, France

International Council for the
Exploration of the Sea (ICES)

Dr. J.F. Pawlak
Environment Officer
International Council for the
Exploration of the Sea
Charlottenlund Castle
DK-2920 Charlottenlund
Denmark

International Union for the
Conservation of Nature (IUCN)

Dr. R. Gouilloud
International Union for the
Conservation of Nature
Les Uttins
1110 Morges
Switzerland

ANNEX IV

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

The sixth and seventh sessions of the Working Group were held in Delft, Netherlands and in London under the Chairmanship of P.G. Jeffery from 9 to 13 May and from 4 to 6 July 1977, respectively.

The Working Group continued with the evaluation of the substances listed in classes 6.1 and 8 of the International Maritime Dangerous Goods Code (IMDG Code) and completed this work. The Working Group further reviewed existing hazard profiles of fatty acids and evaluated a number of other fatty acids.

The Working Group considered, as requested by GESAMP at its ninth session, the definition of the term "bioaccumulation". The Working Group recognized the different mechanisms by which "bioaccumulation" may take place and that the time scale of the various processes will necessarily differ. The Working Group concluded, however, that the end result as far as the target animal is concerned, will be the same. With this in mind the Working Group reconfirmed the symbols used in the hazard profiles, but agreed also that in time it may be possible to separate the various mechanisms of uptake and then adopt a more detailed categorization.

As requested by GESAMP at its ninth session, the Working Group considered the scientific aspects of the development of criteria for determining "harmlessness" of materials listed in Annex I to the London Dumping Convention.

In discussing the problems, the Working Group developed a list of factors which have to be considered in determining effects on marine organisms, particularly with regard to determining whether or not the minimum criterion for exposure to the substance could be met in a particular situation.

The Working Group then considered possible procedures that may be followed for the determination of harmlessness, including provisions for a consultation procedure and the use of fixed limits based on scientific considerations.

LIST OF PARTICIPANTS

Dr. P.G. Jeffery (Chairman)
Deputy Director (Resources)
Warren Springs Laboratory
P.O. Box 20
Stevenage, Herts.
United Kingdom

Dr. J.E. Portmann
Fisheries Laboratory
Remembrance Avenue
Burnham-on-Crouch
Essex
United Kingdom

Dr. C.H. Thompson
Manager
Battelle
Office of Hazardous Materials Research
2030 M Street
Washington, D.C. 20036
United States of America

Dr. B-E. Bengtsson
Brackish Water Toxicology Laboratory
Swedish Environment Protection Board
Studsvik S-611 01
Nykoping, Sweden

Mr. L. Føyen
Institute of Marine Research
P.O. Box 2906
5011 Bergen, Norway

Dr. D.M.M. Adema
Central Laboratory TNO
P.O. Box 217
Delft
Netherlands

Dr. B. Ballantyne
Medical Division
Chemical Defence Establishment
Porton Down
Wiltshire SP4 OJQ
United Kingdom

Mr. T.A. Wastler
Chief, Marine Protection Branch
Division of Oil and Special Materials
Control
Environment Protection Agency
401 M Street SW
Washington, D.C. 20460
United States of America

Dr. K.W. Wilson
North West Water Authority
Rivers Division (Biology)
Dawson House
Great Sankey
Warrington, Cheshire
United Kingdom

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

The interim report of the Working Group on Interchange of Pollutants between the Atmosphere and the Oceans was prepared at an intersessional meeting held in Dubrovnik in October 1977.

The following background papers, prepared by the members of the Group, were discussed:

1. Dr. W. Garrett
"Pollutant modification of physical and chemical processes at the air-sea interface"
2. Dr. L. Hasse
"Peculiarities of the sea surface"
3. Dr. P. Liss
"Interfacial exchange of gases"
4. Dr. V. Pravdić
"Mechanisms governing the interchange of pollutants between the atmosphere and the oceans"
5. Dr. V. Smagin
"Assessment of the effects of petroleum surface films on the heat-, moisture- and gas-exchange between the atmosphere and world ocean waters"
6. Dr. M. Waldichuk
"Introductory review of the state of knowledge in the field of interchange of pollutants between the atmosphere and the oceans"
7. Overview of Sea-Air Exchange Program (SEAREX) ⁽¹⁾

An "Introductory Review of the State of Knowledge in the Field of Interchange of Pollutants Between the Atmosphere and the Oceans", one of the terms of reference, was annexed to this report. Following a condensation of the Introductory Review of the State of Knowledge the report discussed the atmospheric life cycle of pollutants in the lower troposphere, exchange mechanisms and fluxes, transport modes toward air-sea interface, pollutant modification of physical and chemical processes at the air-sea interface, atmospheric petroleum hydrocarbons and their flux to the ocean surface in remote areas, as well as regional and local aspects of pollutants interchange.

(1) A programme of the United States National Science Foundation, Office for the International Decade of Ocean Exploration.

LIST OF PARTICIPANTS

Dr. R.P. Chesselet
Centre des Faibles Radioactivités (CFR)
Centre Nationale de la Recherche
Scientifique (CNRS)
Gif-sur-Ivette 91190
France

Dr. R.A. Duce
Graduate School of Oceanography
University of Rhode Island
Kingston, RI 02881
United States of America

Dr. W.D. Garrett
Ocean Sciences Division
Naval Research Laboratory, Code 8330
Washington, D.C. 20375
United States of America

Dr. L. Hasse
Meteorologisches Institut der
Universität Hamburg
Bundesstrasse 55
D-2000 Hamburg 13
Federal Republic of Germany

Dr. P.S. Liss
School of Environmental Sciences
University of East Anglia
Norwich NR4 7TJ
United Kingdom

Dr. V. Pravdić
Center for Marine Research
"Rudjer Bošković" Institute
POB 1016
41001 Zagreb
Yugoslavia

Dr. V.M. Smagin
Arctic and Antarctic Research Institute
Fontanka 34
192104 Leningrad
USSR

Dr. M. Waldichuk
Department of Fisheries and the
Environment
Fisheries and Marine Service
Pacific Environment Institute
4160 Marine Drive
West Vancouver, B.C.
Canada V7VIN6

Dr. I.M. Zrajevskij
Meteorological Applications and
Environment Department
World Meteorological Organization
Case postale No. 5
CH-1211 Geneva 20
Switzerland

ANNEX VISUMMARY OF THE REPORT
OF THE WORKING GROUP ON
MARINE POLLUTION IMPLICATIONS OF SEABED EXPLOITATION
AND COASTAL AREA DEVELOPMENT

The interim report is a result of two intersessional meetings. The first meeting was 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.

The terms of reference of the Working Group as given at the eighth session of GESAMP were reviewed. It was noted that the first task dealt with certain aspects of seabed exploitation which had been examined at the ninth session of GESAMP, been approved for inclusion in the subsequently published GESAMP Reports and Studies No. 7. The second task, "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", was the subject of the present report.

The purpose of the report is to give basic and simple guidelines for the assessment of the effects of coastal area development on the marine environment and its resources. The report is not an exhaustive compendium, but rather presents a brief and practical guide for users having limited scientific, technical and economic resources.

The first section of the report contains a formulation of programmes for collecting basic data. The programmes are separated according to the different scientific or technological disciplines in addition to which specific modifying considerations such as latitude and special ecosystems (e.g. oceanic islands) are discussed.

In the following section of the report, a methodology is developed which could assist in determining the impact of specific coastal area developments by means of a step-wise procedure. In general this procedure should pinpoint the environmental information required for the best decision concerning the use of the resource or the environment. With a knowledge of these requirements, the basic observational programmes can be adjusted accordingly. Instead of generating an exhaustive list of developments, the Group considered a number of specific activities which not only cover different aspects of the environmental assessment but should also be of interest for developing countries. Finally, a series of examples is given in the last section of the report in order to illustrate the procedure.

The Working Group recalled that its role is mainly to deal with the scientific aspects and not the economics of pollution implications of seabed exploitation and coastal area development. Nevertheless, it appears to be incumbent on scientists to draw attention to the full range of problems that can arise if particular types of coastal ecosystems are not protected.

LIST OF PARTICIPANTS

Dr. H.A. Cole (Chairman)
Forde House
Moor Lane
Hardington Mandeville
Yeovil BA229 9NW
Somerset, United Kingdom

Dr. M.J. Cruickshank
U.S. Geological Survey
620 National Center
Reston, Virginia 22092
United States of America

Mr. R.D. Gerard
Senior Research Associate
Lamont-Doherty Geological Observatory
of Columbia University
Palisades, New York 10964
United States of America

Mr. J.M. Goodman
Project Manager
Frederic R. Harris, Inc.
Consulting Engineers
3003 New Hyde Park Road
Lake Success, New York 11040
United States of America

Dr. G. Kullenberg
Institute of Oceanography
Göteborg University
Stigbergstorget 8
Box 4038
400 40 Göteborg
Sweden

Professor L. Mendia
Institute of Water Supply and Waste
Disposal
Faculty of Engineering
University of Naples
Piazzale Tecchio
80125 Naples, Italy

Dr. M. Waldichuk
Senior Scientist
Department of the Environment
Fisheries and Marine Service
Pacific Environment Institute
4160 Marine Drive
West Vancouver, British Columbia
Canada

Mr. H.R. Oakley
IDODM WATSON
Civil Engineers 767
Tufton Street, Westminster
London SW1P 3QT
United Kingdom

Mr. B. Smale-Adams
Rio Tinto Finance + Exploration Ltd.
P.O. Box 133
6 St. James Square
London SW14 4LD
United Kingdom

Mr. L. Neuman
Technical Secretary (GESAMP)
Office of Ocean Economics and
Technology Office
United Nations
New York, New York 10017
United States of America

ANNEX VIISUMMARY OF THE REPORT
OF THE WORKING GROUP ON
BIOLOGICAL EFFECTS OF THERMAL DISCHARGES
IN THE MARINE ENVIRONMENT

The Working Group report has been produced by its Chairman, Dr. V. Pravdić. The report itself is the product of consultations through mail, since the Working Group did not have the support needed to meet in the intersessional period between GESAMP IX and X.

The knowledge on effects of temperature changes in the marine environment is increasingly being augmented by data emerging from the fields of physical - and biochemistry, molecular biology and physiology. Therefore the frequently expressed opinion that thermal effluents pose no provable detrimental effect should be qualified. Thermal effluents emerging from point sources (power plants, chemical processing plants) properly sited to ensure mixing with large body of ocean waters pose no acute, short-term harmful effects. Delayed or long-term effects, based on co-operative action of heat and biocides, heavy metals, petroleum hydrocarbons are mostly sublethal and difficult to trace. Bioassay studies are still few and far between. Particularly it is being felt that a more detailed insight into molecular processes influencing the physiology of marine biota in co-operative action of thermal and other forms of pollution should be necessary.

If full endorsement of the use of heated effluents in aquaculture is being sought, an explicit statement on whether any detrimental effects can be expected or not is urgently needed since rarely, if ever, coastal regions will be available with unpolluted waters in the extreme sense of this term. Dismissal of thermal effluents as a significant form of pollution requires careful search for hard data evidence. Also, defining proper siting guidelines would require more information than that defining allowable temperature differences and convectional mixing conditions.

Proper siting of effluents in the ideal sense will be largely impossible, since local or regional interest, competition for land use and property evaluation will impose restrictions and force compromises. Thus, a task is seen in defining the maximum tolerable limits if initial conditions include already a certain level of pollution by other pollutants.

Evidence produced in studying the effect of chlorination of seawater and of combined effects of biocides in heated effluents is also warranting further studies.

Of major importance are also the reverse aspects of thermal impact. A clear understanding is needed what pollutants are permissible in generally accepted limits in the extremes of climate. While some pollutants may be tolerated in cold climate, they would be intolerable in tropic.

It was concluded that

no convincing data are at hand to prove the harmfulness of thermal effluents;

chemical and physical effects are reversible and limited to localized areas;

entrainment and entrapment have no global impact;

uptake, accumulation and metabolism of certain pollutants might be significantly altered by temperature changes;

there is a need for detailed studies to compare the effects of thermal discharges versus natural temperature changes;

not only detrimental, but also beneficial, effects have been observed, e.g. the use of heated water in aquaculture;

localized biological effects were recognized due to chlorination processes.

Since it was felt that the information available was not sufficient to enable GESAMP to make further significant contributions, the Working Group was suspended until GESAMP XI.

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

The report of the Working Group on the Monitoring of Biological Variables related to Marine Pollution has an interim character and is based on results of two meetings - the first in Aberdeen (15-16 December 1977) and the second in Paris (26-27 May 1978).

The Working Group had decided first to examine carefully its terms of reference to ensure that there was no duplication of earlier activities or significant overlap with ongoing or planned work elsewhere. This evaluation convinced the Working Group that GESAMP could make a new and useful contribution in the defined field. The Working Group had proposed principles for the selection of biological variables to be used in the monitoring of pollution, and discussed the important intrinsic and extrinsic criteria but determined that further work is required to translate these principles into practical procedures.

In its report, the Working Group drew attention to how these principles could be applied in practice to existing monitoring programmes and gave two examples. First, the application of quantitative indicators (physiological, cytological and biochemical indices) of the health of the organism and of its population in mussel watch programmes; and second, the use of easily detectable effects, such as skeletal deformities, in a general fish survey. It was stressed that while there were many good ideas in the defined field, few of these had been followed up.

The Working Group places great importance on the forthcoming ICES Workshop on Biological Monitoring and considers that its definitive report on practical procedures should not be finalized until the results of this Workshop become available to it. This will be facilitated by the presence at the Workshop of several members of the Working Group who will be attending in any event.

In addition, the Working Group intends to review critically and comment upon the present relevance of the report of the SCOR Working Group on Monitoring in Biological Oceanography to the problems of introducing effects monitoring into pollution programmes.

After due consideration of these reports and additional materials, the Working Group intends to produce a report containing substantive recommendations on a suite of biological variables suitable for monitoring effects of marine pollution in a range of environmental situations on a global scale.

LIST OF PARTICIPANTS

Dr. B. Bayne
IMER
Prospect Place, The Hoe
Plymouth PL1 3DH
United Kingdom

Dr. B-E. Bengtsson
Brackish Water Toxicology Laboratory
Studsvik
S-611 01 Nyköping
Sweden

Dr. R.P. Chesselet
Centre des Faibles Radioactivités (CFR)
Centre National de la Recherche
Scientifique (CNRS)
Gif-sur-Ivette
91190 France

Dr. G. Kullenberg
Institute of Oceanography
Göteborg University
Stigbergstorget 8
Box 4038
400 40 Göteborg
Sweden

Dr. A.R. Longhurst
Marine Ecology Laboratory
Bedford Institute of Oceanography
Dartmouth NS
Canada B2Y 4A2

Dr. A.D. McIntyre (Chairman)
Marine Laboratory
P.O. Box 101
Victoria Road
Aberdeen AB9 8DB

Dr. W. Slaczka
(Unesco Technical Secretary for GESAMP)
Unesco
7 place de Fontenoy
75700 Paris
France

Dr. K.W. Wilson
North West Water
P.O. Box 12
New Town House
Buttermarket Street
Warrington WA1 2QG
United Kingdom

