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JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS OF MARINE POLLUTION
– GESAMP –

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No. 33 1988

Report of the Eighteenth Session

Paris, 11-15 April 1988

United Nations Educational, Scientific and Cultural Organization

Reports and Studies No. 33

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NOTES

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

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DEFINITION OF MARINE POLLUTION BY GESAMP

"Pollution means the introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) which results in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality for use of sea water and reduction of amenities".

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CONTENTS

1. OPENING OF THE SESSION

1.1 The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) held its eighteenth session at the Headquarters of the United Nations Educational, Scientific and Cultural Organization (Unesco), Paris, from 11 April to 15 April 1988, under the Chairmanship of Ms. G.D. Howells. Mr. H.L. Windom was Vice-Chairman.

1.2 At the opening of the session, the Secretary of the Intergovernmental Oceanographic Commission, Mr. M. Ruivo, on behalf of the Director-General of Unesco, welcomed the participants. He stressed the importance Unesco and IOC attach to GESAMP, notable in the support to several Working Groups. In this connection, Mr. Ruivo informed the Group that the Director General of Unesco intends to explore with the Heads of the Co-sponsoring Organizations the possibility of a closer association of IOC with GESAMP than at present. In particular, Mr. Ruivo also noted the interdisciplinary nature of GESAMP, and the significance of this in providing an integrated evaluation of the scientific aspects of marine pollution together with relevant interpretations of the implications of marine pollution for the marine environment, its resources, and the long-term changes occurring in this very important part of the global environment. Mr. Ruivo also noted the potential role of GESAMP as an advisory body to the sponsoring Agencies, and through them to their Member States, in relation to the follow-up of the report of the World Commission on Environment and Development. Mr. Ruivo also pointed out the importance of GESAMP working through the concept of consensus with the involvement of leading experts in their fields and, in most cases, on the basis of reports prepared intersessionnally by Working Groups. In this way the GESAMP mechanism involves a large part of the scientific community engaged in marine pollution research and monitoring, thus being able to provide advice incorporating a wide spectrum of inputs. One prominant example of this working procedure, Mr. Ruivo noted, was the current preparation of the second GESAMP Review of the State of the Marine Environment. In conclusion Mr.Ruivo wished GESAMP every success in its tasks in general, and at this session in particular.

1.3 The Chairman of GESAMP thanked Mr. Ruivo on behalf of the participants for this encouragement and wishes for a successful session, for the hosting of the session and for the provision of secretariat facilities.

1.4 The Agenda for the session, as adopted by the Group, is given in Annex I. The list of documents submitted to the session relating to particular Agenda items is given in Annex II. The list of participants is given in Annex III.

2. REVIEW OF POTENTIALLY HARMFUL SUBSTANCES (Working Group 13)

2.1 Sub-Group on Nutrients

2.1.1 The Chairman introduced the item referring to the report of the sub-group on nutrients of Working Group 13, Review of Potentially Harmful Substances, pointing out that the report was to be considered for possible adoption after required revisions and amendments. The Technical Secretary for Unesco, the lead Agency for Working Group 13, recalled that the report was the result of a sub-group meeting following the discussions at GESAMP XVII and referred to the report of that Session where the Terms of Reference for Working Group 13 are given together with the intended coverage of the present sub-group report.

2.1.2 The Chairman of Working Group 13, who is also the Chairman of the sub-group, Mr. J. Portmann, introduced the report, pointing out that the main aim was to assess the extent to which increases in the availability of nutrients due to anthropogenic activities affect plant production in the sea and the consequences this may have upon marine life, human health and other parts of the environment. He then highlighted the cause for concern and definitions used, summarized the open ocean and regional reviews given in the report, emphasizing that the latter are meant to be examples, and do not cover all areas of potential concern. Mr. Portmann finally emphasized the sub-group's findings regarding the environmental changes and the strategies suggested for assessment and research. A summary of the report is provided in Annex IV.

2.1.3 The Technical Secretaries of the co-sponsoring Agencies, IMO, WHO, FAO and UNEP, pointed out the need to see the report in the context of a series of reviews specifically dealing with potentially harmful substances, addressing common Terms of Reference.

2.1.4 The Chairman reminded the Group that the Working Group Terms of Reference specifically included sources, budgets, fates and effects of the respective substances, and called for discussion on these topics.

2.1.5 In the subsequent discussion of the report, several experts commended the sub-group for its good work in reviewing the state of marine eutrophication and the factual basis presented in the report. Concern was however expressed that the report did not refer to long-term consequences of a build-up of inputs of nutrients and associated levels. Reference was made in this

context to the increase of population pressure and expected increases of inputs of nitrate and phosphate, if changes were not made which would slow down or reverse present levels of inputs of nutrients.

2.1.6 Several experts emphasized the need to separate the natural and anthropogenic inputs of nutrients; the Mediterranean and the Adriatic in particular were referred to in this context, it being recalled that abnormal plankton blooms were known to have occurred there several hundred years ago. Examples would be provided on the magnitude of anthropogenic inputs. It was also emphasized that the different sources of inputs should be more clearly identified. The group recommended that a more balanced approach to remedial action be taken which will fully consider point-sources as well as area or diffuse sources. Remedial measures should include consideration of low-cost options in addition to the conventional procedures.

2.1.7 It was pointed out that biogeochemical cycles of the major nutrients ought to be summarized in the report. Reference was also made to the recent findings in the Baltic Sea regarding increased primary production and changes in plankton species composition, which should be referred to in the report. The role of micro-organisms was raised and that the changes in the food-chain as a consequence of changes in the community structure ought to be considered.

2.1.8. The definition of eutrophication used in the report appeared to imply that it was necessary to establish enhanced primary production by direct observations in order to meet the definition, and it was pointed out that this is very difficult to achieve. A discussion of regenerated and new production was also lacking. Reference was made to the established dose-response relationships of benthos to organic enrichment, and it was suggested that this be considered in the report, perhaps with the reference to observations in the Skagerrak, where the relevant signals were now being detected, indicating initiation of eutrophication.

2.1.9 It was acknowledged that the report correctly emphasized the importance of establishing fluxes, but that it should attempt also in this respect to differentiate between sources. Reference was made to the report of Working Group 22 (Land/Sea Boundary Fluxes, GESAMP Report and Studies N°32), in which fluxes through river inputs of nutrients are discussed and evaluated on a global basis. It was agreed that this information ought to be referred to in the present report and used in the context of Working Group 13.

2.1.10 Reference was also made to the need to consider atmospheric fluxes of nutrients to the sea, since in some areas these may be the dominant inputs. It was the consensus of the group that emphasis on eutrophication studies should be given to coastal areas which, although they represent a small part of the ocean, are those of greatest significance, since it is there that most of man's activities are concentrated.

2.1.11 With respect to the section on remedial action, considerable concern was expressed that the report could be misinterpreted as justifying a 'no action' approach by legislative agencies, on the basis that not enough is known about the problem. It was pointed out that remedial actions are being taken in many regions concerning diferent sources of nutrient inputs to the sea, including those from agriculture, and that modelling had been used to predict the consequences of different remedial options. The report should be modified in this particular section. Reference was made to a recent OECD report (OECD, 1982, Eutrophication of waters, monitoring, assessment and control, OECD, Paris, pp.150) which deals with remedial action and which should be referred to in the Working Group 13 sub-group report. It was noted that the report made no reference to experience in the Southern Hemisphere and that it should not be inferred that eutrophication did not occur there.

2.1.12 The Chairman of Working Group 26 on the Review of the State of the Marine Environment, Mr. A. McIntyre, said it was hoped that the sub-group of Working Group 13 would be able to provide information on eutrophication to Working Group 26 and indeed the sub-group's first draft report had been made available and Working Group 26 had found it most useful.

2.1.13 Mr. Portmann, in responding to this very helpful discussion, stated that the present report could be revised to accommodate most of the comments without calling for another sub-group meeting. He requested, through the Chairman, that the experts provide him with annotated copies of their reports along with their suggestions and concerns.

2.1.14 It was agreed that the sub-group had met its original Terms of Reference but that the concluding section should mention in a little more detail the options and strategies for remedial actions. It was also agreed that Working Group 26 on the Review of the State of the Marine Environment and Working Group 27 on Long-Term Ecological Consequences of Low-Level Contamination of the Marine Environment should pursue the wider issues and aspects raised in the report concerning eutrophication, especially the assessment and prediction strategies, and the identification of research needs.

2.1.15 It was further requested that the final version of the report include a clear introductory statement on its aim and coverage and, also what it did not cover.

2.1.16 Subject to the inclusion of these additional considerations and final editing, it was agreed that the report should be published in the GESAMP Report and Studies series as N°34.

2.2 Sub-Group on carcinogenic substances

2.2.1 The Unesco Technical Secretary, the lead Agency for Working Group 13, introduced the item referring to the report of the Seventeenth Session of GESAMP which had decided that, for the time being, problems related to carcinogenic substances should be considered in four stages. He explained that, as one component of this work, reviews on what is known concerning carcinogenic effects in marine fish and shellfish should be produced. The document GESAMP XVIII/2/2 represented the draft review of evidence from European waters. Another review of evidence from North American waters was under preparation.

2.2.2 The IMO Technical Secretary recalled that an interest in a review of the problems associated with carcinogenic substances in the marine environment had been expressed by GESAMP since 1982. The new approach adopted at the Seventeenth Session covers the four stages:

-identification of substances suspected and known to be carcinogenic to humans;

-collation of information on levels of these substances in marine organisms;

-risk assessment for human health based on food consumption patterns;

-reviews of available information relating to the marine environment, in particular fish and shellfish.

2.2.3 The Group noted that a list of approximately fifty suspected and known carcinogens was being prepared and information on the concentration of these substances in marine organisms is being collected by the International Maritime Organization.

2.2.4 The WHO Technical Secretary confirmed that studies on sea food consumption patterns are underway, mentioning the Mediterranean

as an example. He confirmed that WHO would proceed to carry out the risk-assessment once the information on the substances and their levels had been received from IMO.

2.2.5 The Chairman of Working Group 13, Mr. J. Portmann, confirmed that the North American review was underway, and that the sub-group expected to meet towards the end of 1988, with the aim of producing a report for adoption by GESAMP XIX. He specifically noted that the draft review on evidence from European waters critically evaluated existing information and pointed at the need for an agreed common approach towards identification of neoplasms and tumours in fish and shellfish.

2.2.6 The Chairman identified two issues for discussion:- the draft review and whether the approach adopted in the work of the sub-group was appropriate to deal with the Terms of Reference, reminding the Group about these, in particular, that they included effects on human health.

2.2.7 Several experts commented on the need to include an evaluation of potential effects on human health and referred to relevant specific studies, e.g. concerning chlorination of discharges, chlorinated substances, chloroforms, bromoforms and persistent (stable) synthetic organics (e.g. benz-pyrenes).

2.2.8 The Group agreed that the work was now well defined and seemed to be progressing well, and that the sub-group should conclude its work on the carcinogenic substances in a consolidated report to GESAMP XIX. It was pointed out by the UNEP Technical Secretary that mutagenic and teratogenic substances were also included in the overall tasks of WG 13 and would have to be covered, for example, in relation to the needs of regional conventions.

2.2.9 Experts pointed out the emerging problems with mutagenic substances and the significance of mutagenicity in the marine environment, and that this problem ought to be considered by GESAMP.

2.2.10 It was pointed out that considerable experience was available on carcinogenic substances from freshwater environments, in particular the North American Great Lakes, and that this ought to be taken into account in the review of North American evidences.

2.2.11 The potential problem associated with the use of antibiotics in aquaculture procedures was mentioned as justifying consideration.

2.2.12 The draft review on evidence from European waters was generally considered very valuable and constructive. It was recognized

that work on this topic was in its early stages; further materials and reviews were in preparation and it was hoped that these would allow the sub-group to develop a balanced view.

2.2.13 It was suggested that the sub-group should also identify needs for further work, for example promoting laboratory work in carefully controlled experiments.

2.2.14 The Chairman confirmed that these comments would be taken into account to the extent possible. He also pointed out that effects on marine biota would be evaluated on the basis of population level rather than individuals.

2.2.15 The Chairman concluded that the Working Group should proceed as agreed and a report should be prepared for GESAMP XIX.

3. EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS (Working Group 1)

3.1 The IMO Technical Secretary informed the Group that the Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships, had met twice during the intersessional period: the twenty-first session was held in Trondheim from 18-22 May 1987 and the twenty-second session in London from 18-22 January 1988. He presented a short summary of the work carried out, drawing particular attention to those issues which needed action or decision by the Group. In this connection the Group noted that the main tasks carried out by the Working Group at its recent sessions were the evaluation of pesticides carried as packaged goods, the finalization of the Guidelines for Evaluating Threshold Values for Tainting of Seafood by Chemical Substances, and the updating of GESAMP Report and Studies N°17. It was also noted that since the implementation in April 1987 of MARPOL 73/78, Annex II (Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk) a large number of queries, comments and requests for hazard evaluation of individual products have been received from the chemical industry and national maritime administrations, and that these had been considered by the Working Group. Summaries of the reports of the twenty-first and twenty-second sessions of the Working Group are shown in Annex V.

3.2 The Group was also invited to take note of the results of an informal discussion between members of the IMO Working Group on the Evaluation of Safety and Pollution Hazards of Chemicals and members of the GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships.

3.3 Under this agenda item the Group was also requested to consider the draft of the revised updated version of GESAMP Reports and

Studies N°17 prepared by the Working Group. A list of contents of the document is included in Annex V.

3.4 The Chairman of the Working Group, Mr.W. Ernst, introduced the reports of the twenty-first and twenty-second sessions of the Working Group. He noted that the questions raised by GESAMP at its seventeenth session concerning the review of lubricating oil additives containing zinc, in particular with regard to the extent of its bioaccumulation in marine organisms, could not yet be answered. The chemical industrty had been requested by the Working Group to carry out experimental work on the release of zinc in the marine environment from zinccontaining lubricant additives, as well as bioaccumulation tests. So far no results of such tests had been made available. The Group expressed its disappointment that no progress had been made in this field. The WHO Technical Secretary informed the Group that there were no known human health risks related to the consumption of food containing relatively high amounts of zinc.

3.5 The Group welcomed the finalization of the tainting guidelines. This was considered as an important step forward in providing guidance for the laboratory testing of tainting potential of chemicals. It was noted that tests described in the guidelines were proposed for finfish. The Group recommended that comparative tests be undertaken with shellfish (e.g. mussels) as test organisms. Several members of the Group queried the definition used by the Working Group in the context of the guidelines as "flavour or odour in the organisms which is not typical of the flavour or odour of the organisms themselves", emphasizing that the test procedure is designed to measure only a difference in flavour caused by exposure to a substance, and that it was rather difficult to define the typical flavour of marine organisms. It was also suggested that in the introduction to the tainting guidelines, the tainting threshold should be clearly identified as being a 24hr TC50 value (TC = Tainting Concentration).

3.6 With regard to the concentration level of 1 mg/l, assigned on a preliminary basis by the Working Group for the "T" ratings, the Group agreed to the views expressed on this matter by the Working Group, noting that during spillages at sea, higher concentrations of chemicals could result.

3.7 With regard to the proposal of the IMO Marine Environment Protection Committee (MEPC) that GESAMP consider the development of criteria for the identification of packaged radioactive materials carried by ships as "marine pollutants", the Group confirmed its position, expressed already many years ago, that

the Working Group should not evaluate the hazards of radioactive substances arising as a consequence of their radioactivity. The membership of the Working Group and its expertise was not appropriate for this task and it was considered that the evaluation of radioactive substances would best be carried out with advice and expertise available from IAEA rather than from GESAMP. The IMO Technical Secretary was advised to inform the relevant IMO bodies accordingly. It was, however, also noted by the Group that a common basis for the evaluation of the hazards of all substances, radioactive and non-radioactive, ought to be developed.

3.8 The Group took note of the problems related to the hazard evaluation of inorganic mercury compounds. In this connection the Group advised the Working Group to take into particular account the long-term fate (e.g. transformation) and effects of mercury compounds introduced into the sea when considering the hazard profiles of such substances. It was confirmed that, when the hazard assessment was for a group or class of compounds, the most hazardous member of that group should be used as the guide for the evaluation.

3.9 The Group agreed to the future working plan of the Working Group, noting the classes of compounds which the Working Group will attempt to review at its next session. The Group requested the Working Group to include copper compounds in its list.

3.10 The Group noted the problems encountered by the Working Group in evaluating the hazards of substances of low solubility, high volatility and low density. In this connection the Group considered briefly the outcome of the informal discussion between hazard experts, as reported by the IMO Technical Secretary under paragraph 3.2 above. The general view was that aquatic "toxicity" values, derived from tests carried out in accordance with internationally agreed procedures, reflect the inherent capacity to cause harm and are useful for comparing the properties of one product with another. For the evaluation of potential hazards which substances may pose to the marine environment, however, exposure tests would have to be carried out.

3.11 Several members of the Group recalled that it had been the position of GESAMP that hazards be evaluated in accordance with the procedures and guidelines agreed in the early seventies by GESAMP and as set out in the MARPOL 73/78 Convention. The whole system has served the Convention very well and it might have serious implications for the implementation of the Convention if attempts were made to change this. It has also been the view

that it was the task of the relevant IMO bodies to take physical properties of substances into account when developing requirements for both discharges at sea and for the carriage of chemicals by ships. The Group felt that, nevertheless, it would be appropriate for the Working Group to comment on the appropriateness of the approaches proposed by IMO bodies on how exposure assessments could be included in the regulatory classification.

3.12 In approving the reports of the twenty-first and twenty-second sessions of the Working Group, GESAMP adopted the hazard profiles revised and completed by the Working Group as set out in the reports, together with the "Guidelines for Evaluating Threshold Values for Tainting of Seafood by Chemical Substances", pending the inclusion of comments made by the Group.

3.13 With regard to the draft text of the updated and revised version of GESAMP Reports and Studies N°17, the Group noted that the text was only recently available and that more time was required to study such a complex and comprehensive document before it could be adopted for publication.

3.14 The IMO Technical Secretary informed the Group that, due to unforeseen circumstances, the last meeting of the Working Group could not be convened before January 1988. Therefore, the submission of the draft document had been arranged at a rather late stage. He pointed out, however, that the hazard profiles it contained had all been circulated in other documents to GESAMP members, and approved by them. It was also noted that the composite list of hazard profiles contained in the document had recently been distributed to all countries and international organizations, including chemical manufacturer's organizations and environmental groups, asking for their comments.

3.15 Several members of the Group felt that clarification of some terms and procedures used in the report would improve the current draft. Particular importance was attached to clarification of the text describing bioaccumulation. The Group agreed that each member of GESAMP should study the draft report during the intersessional period and submit comments, and propose amendments to the IMO Technical Secretary by the end of July 1988. During this period the composite list of hazard profiles would be widely circulated to all countries and international organizations, including relevant agencies concerned with the protection of the environment. After evaluation of the comments received, a revised text would be prepared and the members of GESAMP would be invited to consider the final draft with a view of adopting

it for publications.

3.16 The Group was informed of the progress made by IMO in setting up a computerized retrieval system of data used for the evaluation of substances carried by ships. It expressed its appreciation for the efforts made by IMO in this respect, noting that this would facilitate to a great extent the future work of GESAMP in this field.

4. INTERCHANGE OF POLLUTANTS BETWEEN THE ATMOSPHERE AND THE OCEANS. (Working Group 14)

4.1 The WMO Technical Secretary reminded the Group that the first draft of the report, submitted to the present session of GESAMP, was prepared in 1986 and discussed at the sixteenth session of GESAMP. At that session GESAMP endorsed the report in principle, made a number of comments, and requested the members to send their additional comments to the WMO Technical Secretary. The comments received were taken into account in preparing the second draft of the report. In 1987 the report was reviewed and updated by the members of the Working Group; the results of more recent research were also taken into account. The Group was invited to comment on the present updated version of the report and to decide whether it should be published as a GESAMP report.

4.2 The Chairman of the Working Group, Mr. R. Duce, described the changes to the report that had been made as a result of discussions at GESAMP XVI and XVII. In particular, the mass estimates of carbon exchange between the ocean and atmosphere were updated and the section on the processes controlling carbon dioxide uptake and removal in the ocean were expanded. A significant addition to the report was a section on the atmospheric changes of other radiatively active trace gases than carbon dioxide and their potential impact on climate, particularly methane, nitrous oxide, chlorofluorocarbons, and carbon monoxide. A section on the importance of marine sediments as a sink for carbon dioxide was also added to the report.

4.3 In the general discussion of the report, the role of changes in atmospheric dust and aerosol loadings in affecting climate was raised. It seems that any terrestrial dust transferred to the marine environment from land is likely to have only a small direct effect on climate, since the particles from this source are generally of large size and thus easily removed from the atmosphere by gravitational settling and deposition in rain. A more likely impact is an indirect one, via dust providing potentially 'limiting' nutrients (e.g. iron) for marine plankton

in some regions, and hence influencing the ability of the ocean biosphere to take up atmospheric carbon dioxide. Evidence for such a link between dust input and plankton productivity in some oligotrophic ocean areas has recently received some support from a field measurement programme. As discussed in the report, small size aerosols formed by gas to particle conversion are more likely to play a direct role in climate control. An example of this is the formation of sulphate aerosols over remote ocean areas through the production of dimethyl sulphide by marine plankton and its oxidation to sulphate in the atmosphere. It has been postulated that these sulphate aerosols affect climate through the provision of cloud condensation nuclei which are related to the albedo of the earth.

4.4 It was mentioned that microbiological and chemical processes are interrelated in the sea surface microlayer with potential effects on breakdown of certain organic substances. The sea surface microlayer is enriched with PAHs and PCBs and this can lead to enhanced uptake of these substances by neuston.

4.5 It was pointed out that in marine areas where eutrophication is occurring there were consequent changes in the oxygen balance in the water. Eutrophication is a phenomenon primarily taking place in areas with restricted circulation, whereas this report is taking a global view. Therefore considerations of changes in the oxygen balance were not included in the report.

4.6 It was proposed that some mention should be made in the report of the role of chemical reactivity in affecting the air-sea exchange of chemicals. Similarly, some attention should be paid to the effect of cyclones/hurricanes and other high wind speed events in promoting exchanges across the sea surface.

4.7 A summary of the international research programmes relevant to the airsea exchange/climate issue (e.g. WCRP, WOCE, TOGA, JGOFS) could be incorporated into the Report with benefit.

4.8 The Group agreed that the report should be accepted, subject to incorporation of the amendments outlined above, and should then be published in the GESAMP Reports and Studies Series as N° 36, editorial and publication procedures to be handled by WMO. A brief summary of the report is presented in Annex VI.

4.9 The Chairman of the Working Group reported on a brief meeting of representatives of Working Groups 14 and 22 in Norwich, U.K. in September 1988. The primary purpose of this meeting was to provide written information to Working Group 26 on the Review of the State of the Marine Environment, on the relative importance of the atmosphere and river inputs of trace metals, synthetic organic chemicals and nutrients, to both coastal regions and

the open ocean. A secondary objective was to evaluate whether more detailed calculations should be made by Working Group 14 of the atmospheric input of these substances to regional areas and to the global ocean. This would allow for a more accurate and in-depth comparison of atmospheric and riverine inputs of these substances to the sea. An evaluation of the atmospheric and riverine fluxes to the North Sea and to the North Atlantic Ocean indicated that atmospheric input is apparently significant for many substances. For example, in the North Sea, atmospheric input appears to dominate riverine input for polycyclic aromatic hydrocarbons, hexachlorobenzene, lead, copper, zinc and cadmium. The participants at the Norwich meeting strongly recommended that a workshop, originally proposed by GESAMP XVII, be held in late 1988 to evaluate quantitatively the atmospheric input of these substances to the world ocean.

4.10 The Chairman of Working Group 14 then presented a proposal for topics to be considered at a workshop to be convened by the Working Group in October 1988 at the University of Rhode Island, USA. The objective of this workshop would be to determine the atmospheric input of these substances to the world ocean, in accordance with the third item of the revised terms of reference of Working Group 14 adopted during GESAMP XVII. Comparison of riverine and atmospheric fluxes would also be made. The workshop would have five panels: atmospheric transport; boundary layer exchange; synthetic organics; trace metals; and nutrients. Preliminary results and conclusions from this workshop will be made available to Working Group 26 immediately after the workshop is completed. A follow-up meeting of the panel chairmen and workshop co-chairmen would be held in mid-December 1988 to finalize a draft report of the calculations and conclusions of the workshop participants for presentation to GESAMP XIX in the Spring of 1989. After some discussion the Group endorsed the proposed Workshop.

5. COASTAL MODELLING (Working Group 25)

5.1 The IAEA Technical Secretary, in introducing the work of the Group, described recent progress at his Agency on the development of principles for exempting trivial sources of radiation from regulatory control. An international concensus on the principles has now been achieved, and the intention is to apply them to marine disposal with the objective of determining what types and quantities of radioactive material may be dumped without special permit, that is, treated just as if they were non-radioactive materials. The report of the Coastal Modelling Working Group is needed as an input to this programme. Since the GESAMP XVII meeting there have been two meetings of the

Working Group, one in Delft, Holland (May 1987); the other in Vienna, Austria (February 1988). The Group has nine regular experts, and is sponsored by IAEA, as the lead Agency, and UNEP, Unesco and IMO.

5.2 The Chairman of Working Group 25, Mr. Blanton, reviewed the current status of the report noting the problems and likely delay caused by the lack of input so far on sediment modelling. However, he expected that a fairly complete version of the report would be available after the next meeting in Vienna in November 1988. He drew attention to the fact that no single model exists which satisfactorily represents all of the processes influencing pollutant behaviour in coastal environments; the deficiencies in current understanding of processes do not allow such a model to be developed. This did not mean that adequate models for use in predicting the behaviour of pollutant inputs into coastal environments do not exist. In real applications, it is usually only necessary to predict the concentration of pollutants in a few components of the coastal ecosystem, e.g. those associated with identified exposure pathway(s) to man.

5.3 Several comments from the Group concerned the potential importance of pollutant inputs into coastal seas from the atmosphere and of their losses to the atmosphere. These processes have not been included in the modelling treatments developed in the report, the main intention of which is to develop models to answer questions relating to direct inputs of liquids or solids. Assuming that specific pollutants are identified which originate in the atmosphere and are transferred to the coastal ocean, a given conceptual model could, in principle, handle its dispersion. However, it is beyond the scope of the Working Group's activities to include atmospheric transfer processes, per se. It was pointed out that Working Group 14 is specifically dealing with air-sea interchanges of pollutants.

5.4 Mr. Blanton explained the Working Group's intention and plans to obtain the widest possible consultation with model developers to ensure a proper state of the art review. It was suggested that consultation with potential model users might also be valuable.

5.5. The Group expressed its satisfaction with progress on the report and looked forward to seeing a full draft at the next meeting. A brief summary of the present draft report of Working Group 25 is presented in Annex VII.

6. STATE OF THE MARINE ENVIRONMENT (Working Group 26)

6.1 The report of Working Group 26 was introduced by Mr. F. Sella the Technical Secretary of the Working Group. He recalled that the report was prepared by the Core Group of Working Group 26 at its fourth session held at the Palais des Nations in Geneva, Switzerland, from 14-18 December 1987. The session was mainly devoted to a consideration of draft annexes and chapters of the draft report on the state of the marine environment that it was planned to submit to GESAMP for adoption at its XIXth Session. The Core Group had made a number of suggestions related to the annexes and given detailed guidance to the Chairman for the development of a partial draft of the main report which would be attached to the Working Group's report as one of its annexes. That draft report had been prepared by the Chairman, Mr. A.D. McIntyre along with Ms. G. Howells. A summary is attached to the report now under consideration as Annex VIII.

6.2 In the course of the session of the Core Group, two joint meetings were held with the rapporteurs of the Task Teams preparing the reviews of the state of the marine environment in regional seas. The draft reports of the rapporteurs have recently been sent to the members of the Core Group and its experts so that they can be reflected as necessary in revising the texts for which they were responsible.

6.3 The Technical Secretary indicated where the draft report differed from the outline approved by GESAMP at its XVIIth Session and pointed to the numerous gaps that it still had. He underlined that it could only be regarded as preliminary, but that remarks on coverage, balance and size, and of course its factual accuracy, would help the Core Group in developing the text. He paid tribute to the contribution made by the workshop composed of members of Working Group 14 and Working Group 22, on whose report the section on transport and fluxes across boundaries was essentially based. He also underlined the assistance that IMO had made and would continue to make to the Core Group by providing it with the annexes on which the sections on disposal of contaminated sediments and on marine transportation of oil and other hazardous products were based, and by undertaking to provide annexes that would underpin certain weak parts of the report, but particularly by providing the basis for the section on prevention and control.

6.4 The Chairman of the Working Group, Mr.A. D. McIntyre, explained how the section on trends and forecasts, originally envisaged, could now be subsumed under the final section "overview". He mentioned that it was planned to cross-index the report to its annexes and to other Working Groups' reports and that it would include tables and illustrations. While the table of contents was nearly final, he asked for some flexibility in its ultimate structure, particularly with regard to both contents and location of the section on selected contaminants, and to the possibility

that the contents of the section of the terrestrial impact of marine contaminants might be reapportioned to other sections.

6.5 The debate made it apparent that the draft provided a useful basis for the development of a report, reflecting a major effort on the part of the Working Group, and in particular of the Chairman. In its present preliminary form, however, it was considered too bland and seldom came out with firm statements on which issues were to be regarded as of major and global importance and what was their scale, incidence, predictability, avoidability, and/or containability. The report did not always make clear which phenomena were of natural origin (climatic, tectonic, stochastic) and which were due to human activities. Quantitative statements should be made wherever possible.

6.6 In general it was felt that while the principal conclusions were still to be drafted, and included in the last section, they should also be clearly highlighted with clear statements in the body of the text. These, however, would need to be drafted with great care, particularly when numbers were being quoted, lest the report be misinterpreted or, worse, misused. Numbers should be quoted only when it could be ascertained that they were significant, and the time and space intervals to which they applied were clearly identified.

6.7 Any redraft of the text should, to the extent possible, compare the statements made by GESAMP in 1982 with the new ones, and underscore both new facts and new interpretations of old ones. The emphasis on the need for data quality control in the draft offered the opportunity to explain why a good deal of old data were of poor or dubious quality, and had led to misconceptions about contaminant levels in the marine environment.

6.8 While it was essential that the report reflect the findings of the regional reviews with regard to coastal waters, it was underlined that this should not imply the inclusion merely of mere summaries of those reports but the preparation of outlines of the major problems in different climatic and ecological areas e.g. tropical versus temperate seas. In addition, the report should emphasize that the perception of problems, and the way to meet them, varied from one geographic area to another.

6.9 The basis for the selection of both topics and contaminants for review should be clearly spelled out. Concerning the latter, not only should the advisability of including less well-known contaminants, such as benzo-furanes, be considered but some important omissions such as the problem of sediments should be put right.

6.10 The group noted that the section on climate would be radically revised, based largely on the report of Working Group 14 and

on new information that was rapidly accumulating, particularly on the expected effects of such sea-level rises as increased atmospheric concentrations of greenhouse gases may bring about. It also noted that the section on economics was still needed, and requested the Secretariat to find means to make possible the preparation of a substantial section on this subject.

6.11 A number of detailed comments were made and recorded by the Chairman and Secretary. Many more were expected and members were urged to put those in writing and to hand them to the Chairman of the Working Group.

6.12 At the close of the debate, the need to give priority to the problems identified was emphasized, as well as the need to adhere to a consistent approach that would make clear, throughout, the connections and interactions that tie the seas to the rest of the environment.

7. LONG-TERM ECOLOGICAL CONSEQUENCES OF LOW-LEVEL CONTAMINATION OF THE MARINE ENVIRONMENT (Working Group 27)

7.1 The FAO Technical Secretary introduced the report of Working Group 27 which had held the first session from 13 to 17 July at the Institute of Marine Environmental Research, Plymouth, UK.

7.2 The Chairman of the Working Group, Ms. G. Howells, explained that the Group had recognized that long-term changes in marine ecosystems had been observed, and that there was concern that the polluted conditions resulting from accidents or localised discharges would extend on a wider and more persistent scale. The Working Group had considered whether suitable long-term time-series data could provide evidence of such change and if causal factors could be identified.

7.3 From the review by the Working Group of a variety of time-series data it was concluded that there was good evidence of change, but that natural biological fluctuations often obscured effects that might be attributable to a contaminant at low concentration. Natural variations in climate and independent anthropogenic activities (such as fishing) also made interpretation more difficult. However, time-series for possible future analysis were identified. A brief review of the work of the Working Group is included in Annex IX.

7.4. It was recognized that a conceptual framework would be necessary to establish the principles for assessing evidence of damage due to low levels of contamination. This framework could be used in a variety of cases to ask if there is indisputable

evidence of change, whether this is permanent or reversible, and whether a cause can be identified. Further, it should be possible to identify a sequence of effects which could be used to signal the early stages of damage, and to assess what kind of changes are significant for maintenance of ecological functions.

7.5 The Working Group Chairman also noted that members of the Working Group had questioned the scope of the terms of reference and sought the guidance of GESAMP on whether these should be revised. In response, the Group took the view that the terms of reference should remain essentially the same, with minor clarification of wording.

7.6 The UNEP Technical Secretary reminded the Group that the threat of long-term ecological changes, which may be due to persistent exposure to low concentrations or slow accumulation of contaminants in the marine environment was of major concern to GESAMP and was reflected in statements contained in several GESAMP reports. In addition, UNEP's policy on marine environmental protection is largely based on the assumption that the prevention of the slow but persistent build-up of contaminants in the marine environment should be one of the cornerstones of marine pollution control strategy. The evidence for, and significance of, slow but long-term ecological changes, which may be related to build-up of contaminants in the marine environment, is frequently challenged by policy-makers and scientists. Therefore, UNEP is attaching a great importance to the first two items of the Working Group's original terms of reference, and expects that the future activities of the Working Group will not concentrate on theoretical considerations without basing them on examination of concrete and typical case studies.

7.7 In the ensuing discussion, it was emphasized that anthropogenic effects must be distinguished from natural effects. For some contaminants a study of coastal areas might be more useful than a study in the open ocean where natural effects could be expected to predominate. Further, some higher trophic communities (e.g. benthos) which were more stable, would be more suitable targets for investigation than the rapidly changing and adeptable plankton. Methods appropriate for the detection of subtle changes were needed, along with understanding of the dose-response relationship, so that findings could be extrapolated to low levels of contamination, including, in some cases, levels in deep water beyond coastal areas. Such considerations could lead to the formulation of a focussed monitoring programme. In some cases it would be possible to consider very long term (geological) timescales of change by reference to ice cores or to coral growth rates.

7.8 In conclusion, it was agreed that the best way to continue the work was to form a small ad hoc group of GESAMP members to develop a framework and principles for a structural approach in advance of the next meeting of the Working Group. This ad hoc group would consist of Ms. Howells,Mr. Gray, Mr. Calamari and Mr. Wells.

8. FUTURE WORK PROGRAMME

Review of potentially harmful substances (Working Group 13)

8.1 It was decided that the work of Working Group 13 would continue intersessionally without change of the terms of reference as follows:

Sub-group on nutrients: the report reviewed at this Session would be revised and amended according to the comments made, and further written suggestions received, jointly by the Chairman, Mr.J. Portmann, and the Technical Secretary (Mr. G. Kullenberg), whereafter the report would be published in GESAMP Reports and Studies Series, with N°34.

8.2 Sub-group on carcinogenic, mutagenic and teratogenic substances

The work on carcinogenic substances should proceed according to the plan and discussion under Item 2.2, with the aim of presenting a report for adoption at GESAMP XIX.

The work on mutagenic substances would be initiated through soliciting a review on what is known regarding mutagenic substances and the significance of mutagenicity in the marine environment, to be discussed at GESAMP XIX with the aim of defining further work on this matter.
The work on teratogenic substances will be initiated intersessionally in the same way, through a separate solicited review.

8.3 Sub-group on oil,including used lubricating oils, and oil-spill dispersants

The work will be to prepare a summary document on the major new facts and principles pertaining to marine oil pollution and covering petroleum oils, used lubricating oils, and dispersants. The summary document would be based entirely upon available recent syntheses on this topic, and new original papers of major significance. A consideration would be made of analytical, chemical, biological and health aspects of the issue. An annotated draft outline of the proposed report would be prepared intersessionally for GESAMP XIX, May 1989, for consideration and review.

8.4 Sub-group on chlorinated hydrocarbons

The work will be initiated intersessionally through the preparation of a proposal with an outline of content of the review on how to deal with this group of substances. This would be produced through a small ad hoc meeting.

8.5 Intersessional work

Following the above decision, the Group noted that intersessional work would take place on the subjects listed below. The sponsoring organizations responsible for coordinating the intersessional work and the GESAMP members assigned to each working group are indicated. Additional GESAMP members and experts from outside GESAMP will be selected by the Chairmen of the working groups in consultation with the relevant organizations.

.1 Evaluation of the Hazards of Harmful Substances Carried by Ships (Working Group 1).

Lead agency : IMO
Cooperating Agency: UNEP
Chairman : W. Ernst
Member: P. Wells

.2 Review of Potentially Harmful Substances (Working Group 13)

Lead agency : Unesco
Cooperating Agencies : UNEP, FAO, WHO, IMO

Subgroups :
(a) carcinogenic substances, Unesco; J. Portmann
(b) oil, IMO : P. Wells
(c) Chlorinated hydrocarbons : FAO; D. Calamari; J. Portmann

.3 Interchange of Pollutants between the Atmosphere and the Oceans (Working Group 14)

Lead Agency : WMO
Cooperating agencies : UNEP, Unesco
Chairman : R. Duce
Members :P. Liss, H.L. Windom

.4 Coastal Modelling (Working Group 25)

Lead agency : IAEA
Cooperating Agencies : UNEP, Unesco, IMO
Chairman : J. Blanton
Member : J.M. Bewers

.5 State of the Marine Environment (Core Group of Working Group 26)

Lead Agency : UNEP
Cooperating agencies : UN, FAO, Unesco, WHO, WMO, IMO, IAEA
Chairman : A.D. McIntyre
Members of the Core Group: P. Liss, A. Tsyban, G.D. Howells, P. Tortell, H.L. Windom, J. Broadus, H. Shuval, A. Salo.

.6 Long-Term Ecological Consequences of Low-level Contamination of the Marine Environment (Working Group 27)

Lead Agency : FAO
Cooperating agencies : UNEP, Unesco, IMO
Chairman : G.D. Howells
Members : J. Gray, A. Kapauan.

Other Intersessional work

8.6 The IMO Technical Secretary informed the Group that the Intergovernmental Panel on Radioactive Waste Disposal at Sea (IGPRAD), at its first meeting (London, 19-23 October 1987), considered the question of whether it can be proven that any dumping of radioactive wastes and other radioactive matter at sea will not harm human life and/or cause significant damage to the marine environment. The Panel felt that absolute safety cannot be proven in any human activity and that the above question was impossible to answer without prior development of operational definitions of the terms "harm", "safety", "proof", "significance" and other terms which may be required for the development of answers to this question.

8.7 The Group noted the difficulties described by the IMO Technical Secretary and expressed its sympathy. However, a number of members of the Group noted that:

.1 It was difficult to develop uniform definitions which could be used for all aspects of marine pollution (effects on marine life, human health, reduction of amenities, etc.);

.2 It was difficult to develop interpretations of terms used in the fields of hazard and risk assessments without taking into account the specialized contexts in which the terms are applied;

.3 Terms used in international conventions have quite often been deliberately left without a precise definition in order to allow Contracting Parties to develop their own interpretations relevant to the national context;

.4 The work related to the interpretation of terms used in Conventions was rather the task of advisory groups established within the framework of those conventions. The proposed exercise would be useless if it was out of context with the convention which it was designed to serve.

8.8 Other experts felt that it was worthwhile to make at least an attempt to respond and provide in-depth advice on the matter,

and the Group agreed on the following actions:

.1 The preparation of a pilot study, addressing a selected list of terms, to be carried out by one expert or a small group of experts which could work by correspondence and report directly to IMO;

.2 The selection of three or four terms, the review of their existing interpretation and fields of application and where necessary, the development of a more "generic" scientific interpretation for consideration by GESAMP which might then reconsider the merits of establishing a formal Working Group.

8.9 The UNEP Technical Secretary pointed out the need to provide the parties and the secretariats of the eight international conventions, negotiated in the framework of UNEP-sponsored Regional Seas Programme with scientifically accurate definitions of certain terms, applicable to their legal interpretation. In view of the difficulties which may be encountered in providing such definitions, he suggested that in the intersessional period the secretariats of LOS, LDC, Oslo and Paris Conventions and Regional Seas conventions prepare for consideration of GESAMP XIX:

(a) an analysis of the current definition, usage and interpretation of the terms: "pollution", "contamination", "prevention of pollution", and "control of pollution", and

(b) a list of terms for which definitions would be needed.

8.10 The Group endorsed this proposal. The IMO Technical Secretary noted that in the list of the conventions to be analyzed the Marine Pollution Convention MARPOL 73/78 should be included. He further pointed out that the approach adopted would not solve the immediate problem encountered by the Intergovernmental Panel on Radio-active Waste Disposal at Sea (IGPRAD) as mentioned in paragraph 8.6 above.

8.11 The Group agreed that for the evaluation of the terms for which development of operational definitions had been requested by the IGPRAD Panel (harm, safety, proof, significance) the following approach should be used:

.1 To identify a co-ordinator;

.2 To contact GESAMP members by correspondance as well as outside experts working in the fields concerned, asking them to express their willingness to assist in the task of examining the current usages of terms in the marine pollution literature, to identify inconsistencies, to examine the implication of such

inconsistencies and to develop alternative interpretations which might overcome these problems;

.3 To preview the material received from the above experts and to approach legal experts asking them for comments;

.4 To submit the material to the next meeting of GESAMP for consideration and further evaluation.

8.12 The Group noted that another task discussed at the IGPRAD meeting in connection with sea disposal and alternative land-based disposal options, was the development of a common, comprehensive and integrated framework for the regulation and assessment of dumping at sea of all types of wastes, i.e., radioactive as well as non-radioactive wastes. In the light of discussions on similar issues during this session, it was suggested that it would be appropriate for GESAMP to develop this concept further.

8.13 The IMO Technical Secretary informed the Group that the LDC Scientific Group on Dumping is currently involved in a similar exercise.The Secretariat therefore considered that in the first instance the LDC Scientific Group be requested to consider the task raised by the IGPRAD Panel.

9. DATE AND PLACE OF THE NEXT SESSION

9.1 The Group noted that the nineteenth session of GESAMP would be hosted by UNEP and held at the Co-ordinating Unit for the Mediterranean Action Plan, Athens, Greece, from 8-12 May 1989, commencing on Monday 8 May, at 2 p.m.

The Group urged the Technical Secretaries to distribute documents for consideration at the nineteenth session no later than 10 March 1989. In particular, it was noted that reports submitted for final approval could not be considered adequately if they were not in the hands of the experts at least one month before the Session.

10. OTHER MATTERS

Definition of marine pollution

10.1 The Chairman introduced the item referring to Document GESAMP XVIII/10, pointing out that the GESAMP definition of marine pollution has stood the test of time, but that in recent years, several new trends in marine and environmental protection in general had arisen. The precautionary approach (Vorsorgeprinzip)

and other management and prevention strategies had raised the question of this fundamental aspect of prevention in the definition. She therefore had prepared a discussion paper specifying some of these questions with the aim of keeping the definition under review and perhaps the preparation of an explanatory note putting the definition into a perspective and context of GESAMP as a scientific advisory body. She invited comments.

10.2 Several experts expressed the opinion that the GESAMP definition of marine pollution was adequate for most purposes, and should not now be revised, but that provision of a note explaining its frame of reference would be useful, together with a clarification of the GESAMP aims and objectives. Certain words in the definition were causing difficulties in some external contexts such as the word 'introduction' and the occasional use of the words "which results in" rather than "resulting in" as originally formulated. Further, there was need to consider a definition of the word "contamination" to complement the GESAMP definition of pollution. This might be elaborated in an explanatory note.

10.3 Experts pointed out that rather than revise the definition of marine pollution, GESAMP should adjust in its own work to the current trends in environmental protection and management efforts. One approach towards this end could be to prepare intersessionally a paper considering the various strategies being used in marine environment protection and management, with a view to examining the possibility of harmonization and the scientific basis for these strategies. Such a paper should draw on several recent reports of GESAMP including the first GESAMP Review of the Health of the Oceans, the report on river inputs, results from the planned workshop on atmospheric inputs, as well as on recent scientific workshops outside of GESAMP, including interactions between the marine, terrestrial, freshwater and atmospheric compartments of the environment. It should result in an evaluation of the appropriateness or not of GESAMP to undertake a major study of these aspects.

10.4 Dr. D. Calamari would be willing to lead this work, which would be dealt with mostly by correspondence, with the understanding that contributions would be received from other experts, in particular Mr. Bewers, Mr. Boelens, Mr. Gray, Mr. Ibe, Ms.Salo, Mr.Tortell, Mr. Wells, Mr. Windom, and also members of the Secretariat.

10.5 The Chairman concluded that this approach should be adopted and that the Secretariat should independently prepare an explanatory note for the definition of marine pollution in

relation to the role and function of GESAMP, taking into account the present trends as discussed.

10.6 The UNEP Technical Secretary offered technical and other support for the preparation of the review paper, and the Unesco Technical Secretary also offered support, including from IOC.

10.7 The suggestion was brought forward that, as part of its future work, GESAMP should consider the need to examine the various impacts on the marine environment caused by the input of suspended particulate matter and sedimentation in coastal areas. Reference was made to the serious consequences of land-use practices which mobilize large quantities of geological material and which greatly enhance the land-sea flux of particulates. Accelerated deposition in coastal areas may change the nature and availability of living marine resources and interfere with human uses of the coastal zone. While the problem is known to be acute in certain developing regions of the world, the operative processes are likely to occur in all areas subject to a high level of anthropogenic activity.

10.8 A number of experts considered that anthropogenically increased rates of sedimentation should be regarded as a potential cause of pollution. While considerable attention was currently being given to contaminants associated with particulate materials, it was acknowledged that scientific investigation into the causes and effects of sedimentation itself may indeed be inadequate. Several members referred to initiatives at present underway at national level to improve the management or control of practices which cause or contribute to high rates of erosion.

10.9 With regard to the possible involvement of GESAMP in sedimentation issues, various opinions were presented concerning the likely extent of the work and the need to identify the different practices, materials and processes involved. It was recognized, for example, that agriculture, forestry, mining, industry and coastal zone development could all be contributing factors and that, as a consequence, the physical and chemical characteristics of the deposited materials, and their effects on the marine environment, could differ widely. It was suggested that the main concern should, however, be the impact of the suspended particulate loads and their deposition rather than the chemical composition. Study of the effects of sedimentation on biota would help to fill the gap in the recently completed review of Working Group 22 of land-sea boundary fluxes which did not cover biological aspects due to the lack of information on the rate of biological processes. It would also be important to consider to what extent sediment transport processes might be addressed. Above all, the nature and scale of sedimentation problems world-wide should be established before reaching a decision to study the matter further.

10.10 Having established that the members generally supported the need for further information on sedimentation problems, the Chairman invited Mr. J. Pernetta who had raised the issue for debate to prepare a review paper for GESAMP XIX, thereby providing input on this matter to Working Group 26. Secretariat technical support would be provided by Unesco.

11. ELECTION OF CHAIRMAN AND VICE-CHAIRMAN FOR THE NEXT INTERSESSIONAL PERIOD AND FOR THE NINETEENTH SESSION

11.1 The Group unanimously elected Mr. H. Windom as Chairman and Mr. D. Calamari as Vice-Chairman for the next intersessional period and for the nineteenth Session of GESAMP.

12 CONSIDERATION AND APPROVAL OF THE REPORT OF THE SESSION

12.1 The report of the eighteenth session of GESAMP was considered and approved by the Group on the last day of the session. It contains, in Annexes IV to IX, summaries of reports prepared by the Working Groups. These summaries are included for information and were not considered by the Group with a view to approval. The Terms of Reference of the Working Groups and lists of members are also provided in the Annexes.

ANNEX I

AGENDA

Opening of the Session

1. Adoption of the Agenda

2. Review of potentially harmful substances

   .1 nutrients
   .2 carcinogenic substances

3. Evaluation of the hazards of harmful substances carried by ships

4. Interchange of pollutants between the atmosphere and the oceans

5. Coastal modelling

6. State of the marine environment

7. Long-term ecological consequences of low-level contamination of the marine environment

8. Future work programme

9. Date and place of next session

10. Other matters

11. Election of Chairman and Vice-Chairman for the next intersessional period and for the nineteenth session

12. Consideration and approval of the report of the session

ANNEX II

LIST OF DOCUMENTS

1. XVIII/1	Administrative Secretary	Provisional Agenda
2. XVIII/2.1	Working Group	Review of potentially harmful substances:nutrients and eutrophication in the marine environment
2. XV/III/2.2	Working Group	Review of potentially harmful substances: cancer in fish and shellfish, a critical review of status in European waters
3. XVIII/3	Working Group	The evaluation of the hazards of harmful substances carried by ships
3. XVIII/Inf 1	IMO	Report of an informal discussion between members of the IMO WG on the Evaluation of Safety and Pollution Hazards of Chemicals and members of the GESAMP WG on the Evaluation of the Hazards of Harmful Substances carried by ships
4. XVIII/4	Working Group	Report of WG 14 on the interchange of pollutants between the atmosphere and the oceans: Pollutant modification of atmospheric and oceanic processes and climate: some aspects of the problem
5. XVIII/5	Working Group	Report of WG 25 on coastal modelling
6. XVIII/6	Working Group	Report of WG 26 on the review of the state of the marine environment
7. XVIII/7	Working Group	Report of the GESAMP Working Group on long-term ecological consequences of low-level contamination of the marine environment

XVIII/Inf. 2	Secretariat	GESAMP Members, Secretariat and Observers
XVIII/Inf. 3	Secretariat	List of documents

ANNEX III

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ANNEX IV

SUMMARY OF THE REPORT OF THE SUB-GROUP ON NUTRIENTS IN THE MARINE ENVIRONMENT OF THE WORKING GROUP ON THE REVIEW OF HARMFUL SUBSTANCES (Working Group 13)

1. This sub-group, which had completed some preparatory work by correspondence in advance of the meeting, met under the Chairmanship of Mr. J. Portmann at Unesco Headquarters, Paris, from 14-17 September 1987.

2. Based on the solicited notes produced in advance of the meeting, the group prepared a report addressing its Terms of Reference including review of experiences from selected regions of the ocean and a listing of the effects of eutrophication on the marine environment with possible strategies for assessment of these effects.

3. Inputs to the marine environment of nitrogen and phosphorus have increased, mainly as a consequence of wide-scale use of fertilizers, the discharge of sewage and industrial wastewater and, at least in some areas, nitrogen oxide emissions to the atmosphere from combustion processes. They are likely to continue to increase where controls are not applied.

4. In some coastal waters and enclosed seas, increased inputs of nitrogen and phosphorus compounds have led to clearly detectable increases in the concentrations of such compounds in the water. The areas so affected are numerous and geographically widespread.

5. The common feature of all the areas affected is a limited water exchange with the open sea. There is no evidence of such increases in open-shelf sea waters or open ocean areas and there seems little likelihood that this could occur in the foreseeable future.

6. In recent years, there have been more frequent reports of phytoplankton blooms of certain species causing problems, especially in enclosed sea areas. There are also suggestions that algal blooms in general tend to last longer and be of greater scale in some areas than in the past, and that they occur at unusual times of the year. In some areas, these increases in algal production have been linked to the increased inputs of nitrogen and phosphorus.

7. The main concern from a human health standpoint in relation to changes in phytoplankton blooms is the fact that certain species give rise to toxins which are accumulated by filter-feeding molluscs such as mussels, clams and oysters and can cause poisoning in man. Three syndromes recognized in this context are PSP=Paralytic shellfish poisoning, DSP=diarrhaeic shellfish

poisoning, NSP=neurotoxic shellfish poisoning. Blue-green algal blooms may also be toxic and cause illness in man and the death of animals. There is evidence from the Japan Inland Sea of increased frequency of toxic phytoplankton blooms in areas that have been subject to major nutrient inputs.

8. In the Baltic the cause for concern stems at least as much from the tendency for nutrients (especially phosporus) to accumulate in the bottom waters and sediments, as from the increasing volume of deoxygenated deep water which arises as the plankton decay.

9. It is possible to identify the types of changes which characterize the progressive stages of eutrophication from early onset to criticality. Some of the parameters can be measured using relatively simple techniques and can help to avoid serious environmental consequences if remedial action is taken at a sufficiently early stage. Modelling of marine eutrophication is at a relatively early stage but is useful for analyzing the consequences of remedial action and potentially for predicting certain events:

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Terms of refence of Working Group 13

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

   a) the total of particular substances which reach the marine environment (on a local, regional and global scale) with particular attention being given to the relative importance of land-based sources;

   b) the fate (transfer, distribution and transformation) of these substances in the marine environment;

   c) the effects of these substances on the marine environment and adjacent coastal areas, both direct and indirect, on living resources, human health and amenitis.

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

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ANNEX V

SUMMARY OF THE REPORT OF THE WORKING GROUP ON THE EVALUATION OF THE HAZARDS OF HARMFUL SUBSTANCES CARRIED BY SHIPS
(Working Group 1)

1. The Working Group met under the chairmanship of Mr. W. Ernst at Trondheim from 18 to 22 May 1987 and in London from 18 to 22 January 1988.

2. The Working Group reviewed a number of hazard profiles and prepared new hazard profiles for a large number of compounds including 180 pesticides carried as packaged goods. Hazard profiles of evaluated substances are set out in Annexes 3 to the reports of the 21st and 22nd Sessions.

3. The Working Group appreciated activities of the oil industry in providing test results on lube oils additives. On the basis of these reports, a number of hazard profiles could be established.

4. Guidelines for evaluating threshold values for tainting of seafood by chemical substances had been finalized and are shown in Annex 4 to the report of the 22nd Session. The guidelines contain a definition of tainting, the experimental procedure to be used and details of how the results should be calculated and recorded. The Working Group proposed 1 mg/l as a threshold level below which a "T" rating would be assigned in column A of the hazard profiles.

5. Difficulties experienced by industry in undertaking marine aquatic toxicological tests had led the Working Group to compile an "Advice for Aquatic Toxicity Testing of Substances or Mixtures containing Substances of Low Solubility". This provides guidance on the procedures for carrying out the tests and for the choice of test species. The use of both small marine crustacea and small fish is recommended.

6. The Working Group identified problems related to the allocation of ratings for bioaccumulation in column A of the hazard profiles, where test data are lacking. In these cases physicochemical data, such as the water solubility and the octanol/water-partition coefficient, were used to calculate bioconcentration factors. The Working Group pointed out that ratings obtained in this way may, due to metabolic transformations, sometimes be too high.

7. The Working Group appreciated the activity of the Secretariat in pursuing the computerizing of the data base. An appropriate

data format has been developed and a computer system will be established in the near future facilitating the exchange of data between the Secretariat and members of the Working Group.

8. The Working Group identified items for priority consideration at its next meeting, which will be held at IMO Headquarters, London, from 29 August to 2 September 1988 as follows: a) consideration of comments of GESAMP-Members on the "Review and Update of GESAMP Reports and Studies N°17"; b) Review of barium and selenium compounds, aldehydes, substituted phenols, esters and inorganic mercury compounds; c) preparation of hazard profiles of new compounds from the industry.

List of Contents

Annex 9
Advice for aquatic toxicity testing of substances or of mixtures containing compounds of low solubility

Annex 10
Characteristics of liquid chemicals proposed for marine transport in bulk

Annex 11
Bibliography

Terms of reference of Working Group 1

1. To enquire and evaluate available data and to provide such other advice as may be requested, particularly by IMO, for evaluating the environmental hazards of harmful substances carried by ships, in accordance with the rationale approved by GESAMP for this purpose (GESAMP IV/19/Suppl. 1 as amended in Rep. Stud. GESAMP, (29)).

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ANNEX VI

SUMMARY OF THE REPORT OF THE WORKING GROUP ON THE INTERCHANGE OF POLLUTANTS BETWEEN THE ATMOSPHERE AND THE OCEANS
(Working Group 14)

1. The report presented by the Working Group and entitled "Pollutant modification of atmospheric and oceanic processes and climate: some aspects of the problem" was drafted in 1986 and updated at the end of 1987. The report considers the effects of greenhouse gases increasing temperature and of aerosols decreasing temperature, oceanic modification of climatic effects of increasing carbon dioxide, as well as contaminants and processes at the air-sea interface that affect the interchange of energy and material influencing climate regionally and even globally.

2. The Working Group was of the opinion that at the first stage of the above studies, attention should be paid mainly to the role of the global ocean in the magnitude and variations of tropospheric carbon dioxide concentrations, knowledge of which is indispensable for modelling and predicting any resulting climatic changes and anomalies. The following matters devoted to the carbon dioxide problem were considered: the global carbon cycle, the effect of the biosphere on CO_2, oceanic modification of climatic effects of increasing CO_2, including the development of sea-surface temperature anomalies, changes in the ocean circulation and distribution of temperature and salinity, and changes in the atmospheric forcing at the surface due directly to the increase in CO_2 partial pressure.

3. The influence of some other radiatively active trace gases (methane, nitrous oxide, carbon monoxide, fluorocarbons) on climate was considered briefly by the Working Group. The common understanding was that these trace species play key roles in tropospheric chemistry and air quality. They could cause a warming of the surface-trosphospheric system, which could be of the same magnitude as the warming due to the projected increases in CO_2.

4. While considering the role of man-made and natural aerosols in the chemical cycles of constituents in the atmosphere and the global climate, the Working Group noted that changing the earth's albedo by aerosol interaction with cloud processes could have a more important impact on climate than the direct reduction of insolation of the earth's surface.

5. The Working Group noted again that the understanding of the chemistry of the atmosphere-ocean boundary and the exchange processes between the atmosphere and the oceans involves knowledge

of the properties of the surface microlayer. In this sense,molecular-level phenomena require special attention and further research.

6. In the statement on process modification by pollutants prepared by the Working Group, it was noted that the pollutant modification of certain atmosphere and ocean-related processes might influence weather and climate, either regionally or on a global scale. Some examples of pollutant effects on such processes were presented.

7. The Working Group considered briefly some international programmes and projects dealing with modification of the atmosphere, ocean-related processes and climate. Summaries of the activities within these programmes are included in the report.

8. The possibility of using the space-based satellite imagery to detect petroleum slicks on the sea surface and to monitor effects of climatic change on oceanic primary productivity, was discussed. It was considered important to continue testing these methodologies to improve their capabilities.

9. Needs in research were determined by the Working Group for a better understanding of the impact of contaminants on the atmosphere and ocean-related processes and climate.

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ANNEX VII

SUMMARY OF THE REPORT OF THE WORKING GROUP ON COASTAL MODELLING
(Working Group 25)

1. The Group has met twice since the 17th Session of GESAMP. The Group met in Delft, the Netherlands, 11-15 May 1987 and in Vienna, Austria, 8-12 February 1988. A full outline of the report has now been agreed.

2. The meeting in Delft began with a discussion of the comments made at the last GESAMP meeting before going on to clarify and differentiate between the contents of Chapter 3 (processes) and Chapter 4 (parameterization). A large number of models were reviewed. As expected, most work has been done on hydrodynamic models with progressively less on sediment transport, geochemistry, biological transport and benthic transport models. Much of the remainder of the meeting consisted of determining the logical framework for Chapter 5 on model construction, of deciding the case studies to illustrate the process of model construction and of reviewing and editing sections on sediment and biological transport in Chapters 3 and 4.

3. The meeting in Vienna reviewed the four case studies of dumping monazite sand, of discharging cadmium into an estuary, of discharging sewage near a beach and of introducing nutrients into an embayment so as to cause anoxic conditions and affect marine life. A common format was agreed and this led to a further clarification of the conceptual framework of the report. A fifth case study on titanium dioxide releases will be examined before the next Working Group meeting. The contents of the remaining chapters on model reliability and conclusions were outlined.

4. A major difficulty at the Vienna meeting was the lack of expertise on sediment transport models. This not only delayed the completion of Chapters 3 and 4 but also created problems in drafting sections on the interdisciplinary links between sediments and other aspects of the overall system. There will be a serious delay to the report if this is not filled before the next working group meeting.

5. Through a close examination of different aspects of case studies of model construction, it became apparent that there may be some confusion about the scope and terms of reference of this report. The current state of the art of coastal modelling does not permit the building of a general purpose model which will provide reliable estimates of the concentration of a contaminant in water, sediment and biota at all places and for all times. However, waste management problems are usually posed in a way which tries to relate the effects of a disposal to the level of waste input. To answer this it is necessary to know how the

waste disperses in the marine environment and how the resulting levels of contaminant concentration are related to the effects of concern - effects such as the level of exposure of man to radiation from consumption of fish or the level of contamination which will cause the closure of a commercial shellfish fishery. This concentration/effects relationship, or effects model, imposes constraints on what can be predicted accurately and reliably by the marine dispersion model - the subject of this report. In other words, the type of marine dispersion model required depends upon the question asked. Thus, the Working Group concluded that a review of the state of the art of coastal modelling and recommendations about the types of models appropriate to specific coastal regimes, as required by the terms of reference, can only be sensibly undertaken with an appreciation of the implications of the effects model on design of the marine dispersion model.

6. At the next meeting, tentatively planned to be held in Vienna, 7-11 November 1988, assuming the sediment transport sections of the report have been written, the process of editing will commence so that the report can be peer reviewed before the final version is presented to GESAMP. A further Working Group 25 meeting is likely to be needed in 1989 to finalize the report.

Terms of reference of Working Group 25

1. To evaluate the state of the art of coastal (including continental shelf) modelling relevant to waste inputs by sea dumping or land-based discharges in such areas;

2. to determine what model parameters are site and source specific and what parameters are generic to different coastal situations and contaminants, and

3. to make recommendations as to the types of models appropriate for specific coastal situations.

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ANNEX VIII

SUMMARY OF THE REPORT OF THE CORE GROUP OF THE WORKING GROUP 26 ON THE STATE OF THE MARINE ENVIRONMENT (Working Group 26)

1. Following the endorsement of the revised outline of the global review by GESAMP in April 1987, the core group held its fourth meeting at the Palais des Nations, Geneva, from 14 to 18 December 1987. The meeting included a joint session with the co-ordinator of the task teams responsible for preparing the Regional Reviews of the State of the Marine Environment.

2. The core group had before it 18 documents prepared as annexes to the Review and four relevant GESAMP reports. These documents were reviewed by the Core Group as a whole and in greater detail by ad hoc groups of members and experts. Following this review, a small editorial group met in London from 8 to 12 February 1988 to prepare an early partial draft report on the State of the Marine Environment to be presented to GESAMP for discussion at its 18th Session

3. This early draft did not contain illustrations, tabular material or cross references to the annexes or to the GESAMP reports, and for several of the sections it contained only a brief summary of the expected results.

4. Nevertheless, the draft provided a detailed forecast of the final form and content of the review. In particular, it confirmed the format of the three main chapters on the levels and distribution of marine contaminants; on human activities affecting the sea, and on biological effects. In addition, for those chapters or sections which had been less fully worked up, it indicated the expected content and provided details where possible.

5. It was recognized that a significant input to the report had yet to be made by the inclusion of data from the Regional Reviews which had been prepared as a separate exercise. It was reported that most of these Reviews were now available. Arrangements had been made for the production of an Annex on Prevention and Control Strategies and this would provide the material for a complete chapter. A brief outline of the possible role of economics expertise in the report was provided and it was planned to make use of this input.

6. At this preliminary stage no attempt had been made to provide an overall assessment and recommendations but these would be added in the next draft.

7. It was proposed that the core group should meet again, possibly in the autumn of 1988, to complete its task by preparing a final report for GESAMP XIX.

Terms of Reference of Working Group 26

1. To prepare, by the eighteenth Session of GESAMP, a draft report consisting of a succinct critical review (up to 40 pages) of the state of the marine environment following as far as possible the pattern of UNSCEAR reports and making full use of the results and conclusions of other GESAMP working groups as well as of the data provided by relevant international and national programmes assessing the state of the oceans;

2. to examine and assess in the draft, global and regional trends, current and /or anticipated, arising from ongoing and planned human activities that, through changes of the ocean's chemical or physical state, may affect:

   (a) the productivity of the oceans at all trophic levels;

   (b) the quality of ocean resources for human use;

   (c) the integrity of the role of the oceans in the energy balance of the earth;

3. to base its draft on detailed technical annexes that will become part of the report.

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ANNEX IX

PROGRESS REPORT OF THE WORKING GROUP ON LONG-TERM ECOLOGICAL CONSEQUENCES OF LOW-LEVEL CONTAMINATION OF THE MARINE ENVIRONMENT
(Working Group 27)

1. The GESAMP Working Group on Long-Term Ecological Consequences of Low-level Contamination of the Marine Environment held its first session at the Institute for Marine Environmental Research (IMER), Plymouth, from 13 to 17 July 1987, under the chairmanship of Ms. G.D. Howells. The session was jointly sponsored by FAO, Unesco, IMO and UNEP; FAO provided the technical secretariat.

2. The hypothesis to be tested is that persistent pollutants at low (non lethal) concentrations will have effects on populations and communities; that these effects will be evident and measurable both in individuals exposed in controlled tests and also in population or community changes. However, a "bottom line" approach might be to note the loss of a particular species from an area and to demonstrate that this loss is associated (i.e. statistically, contemporarily or geographically) with an identified and measured contaminant. Correlation, however, is insufficient alone, and unequivocal confirmation should be sought by experimental exposure of the target organism to appropriate concentrations of the toxic agent and by evidence of some detrimental change that could have a significant adverse effect on the well-being of a population or community. Independent evidence of damage at different locations, or at different times, or observations of damage following accidental release (at appropriate concentrations) could provide supporting, if circumstantial, evidence. Abatement of an identified discharge should be followed by reduction or reversal of the observed damage.

3. Working papers prepared by participants prior to the meeting were presented and discussed in detail. These papers included accounts of relevant studies covering plankton, benthos, fisheries, general ecosystem responses, specific contaminants, temperate and tropical areas, and inshore, offshore and oceanic locations.

4. Issues pertinent to the task of the Working Group which were raised included:

-spatial or temporal coincidence of observed effects and stressing agents; gradients from source to background level may illustrate effects at low-level concentrations;

-need for additional evidence to demonstrate a cause, such as biochemical mechanisms, residue concentration (but presence

alone was not regarded as sufficient);

-stressing agents of importance identified by the studies reported were climatic and seasonal cycles, food availability, larval recruitment and potential for recolonization, exploitation stress, overfishing and potential pollutants or toxins;

-natural cycles and fluctuations make the interpretation of the effects of stress difficult; long-time series data are needed to interpret observed changes;

-cases of adaptation to natural contamination (e.g. oil seeps, mercury or other metals, sediments and turbidity) are recognized; ecosystems may respond positively to enhancement of, for example, bacterial degradation;

-some ecosystems maintain stability by switching between alternate species or between summer/autumn spawning populations; temperate locations may respond differently from tropical or arctic locations;

-pollutants originating from point sources (rivers, discharges, dump sites) should be distinguished from those predominantly of atmospheric origin (possibly PCBs);

-biological (species) interactions are important in some, but not all, cases; predation may or may not be significant;etc;

-sediment cores may provide a record of historic changes in biological community and in levels of stress;

-a need is recognized for standardization of methods, for coordination and intercomparison, for improved sampling techniques, for better data analysis.

These issues were regarded as important in developing the future approach of the Working Group in meeting the Terms of Reference provided by GESAMP.

Terms of Reference of Working Group 27

The Working Group was established at the Sixteenth Session of GESAMP with the following Terms of Reference:

1. To examine the evidence for the slow but long-term ecological changes which may be due to low persistent concentrations or slow build-up of contaminants in the marine envrionment. This would include, for instance, changes in species composition and abundance, in physiological and reproductive and genetic functions affecting ecosystems at population level, in physical

and chemical conditions of affected habitats, etc..);

2. to examine the evidence for rehabilitation and recovery of altered (damaged) ecosystems and habitats, and to study and define the key elements and processes involved;

3. to develop the concepts needed for understanding long-term ecosystem changes influenced by persistent low-level contamination, and

4. to identify gaps in knowledge where additional studies were needed.

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Reports and Studies GESAMP

The following reports and studies have been published so far. They are available from any of the organizations sponsoring GESAMP.

1. Report of the seventh session, London, 24-30 April 1975. (1975). Rep.Stud. GESAMP, (1):pag.var. Available also in French, Spanish and Russian

2. Review of harmful substances. (1976). Rep.Stud.GESAMP, (2):80 p.

3. Scientific criteria for the selection of sites for dumping of wastes into the sea. (1975). Rep.Stud.GESAMP, (3):21 p. Available also in French, Spanish and Russian

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