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

REPORTS AND STUDIES

No. 27

**REPORT OF THE SIXTEENTH SESSION
LONDON, 17-21 MARCH 1986**



INTERNATIONAL MARITIME ORGANIZATION

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INTERNATIONAL MARITIME ORGANIZATION
London, 1986

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) RESULTING IN SUCH DELETERIOUS EFFECTS AS HARM TO LIVING RESOURCES, HAZARDS TO HUMAN HEALTH, HINDRANCE TO MARINE ACTIVITIES INCLUDING FISHING, IMPAIRMENT OF QUALITY FOR USE OF SEA WATER AND REDUCTION OF AMENITIES."

* * *

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Report of the sixteenth session held at IMO Headquarters, London, 17-21 March 1986. Reports and Studies GESAMP (27).

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1 OPENING OF THE MEETING

1.1 The Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) held its sixteenth session at the Headquarters of the International Maritime Organization (IMO), London, from 17 to 21 March 1986, under the Chairmanship of Mr. E. D. Gomez. Mrs. G. D. Howells was Vice-Chairman.

1.2 At the opening of the session, the Secretary-General of the International Maritime Organization, Mr. C. P. Srivastava, welcomed the participants. The Secretary-General, noting that the first session of GESAMP had been convened seventeen years ago on the same date at IMO Headquarters, expressed his congratulations to the Group on this birthday, and also on the achievements of GESAMP throughout these years. The Secretary-General emphasized the importance of GESAMP's work for the implementation of a number of international conventions administered by IMO. Many of the requirements and recommendations developed by IMO are based on the results of GESAMP, such as those related to discharges at sea of residues from chemical tankers, the carriage of chemicals by certain ship types, the identification of dangerous packaged goods as marine pollutants, the development of categories for the search and recovery of packaged goods accidentally lost at sea, as well as criteria for the selection of ocean dumping sites and the identification of hazards of substances dumped at sea. These have been incorporated in legal instruments, guidelines and resolutions adopted by IMO Member States. Emphasizing also the important work carried out by GESAMP for the other sponsoring agencies, the Secretary-General on their behalf expressed his gratitude to the scientists who either directly or indirectly have contributed to GESAMP work. In conclusion, the Secretary-General wished the Group every success at this session.

1.3 The Chairman of GESAMP thanked the Secretary-General of IMO on behalf of the participants for his good wishes for the success of the session, for hosting 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 items of the agenda, is given in Annex II.

1.5 The list of participants is shown in Annex III.

2 REVIEW OF POTENTIALLY HARMFUL SUBSTANCES (Working Group 13)

2.1 The WHO Technical Secretary in introducing the intersessional work accomplished by the Working Group on the Review of Potentially Harmful Substances emphasized in particular the diversity of activities of the Working Group and the variety of harmful substances and groups of substances addressed (i.e. arsenic, mercury, selenium, organosilicons and carcinogenic substances). The Chairman of the Working Group then outlined the scope and content of the draft documents and summarized the conclusions of each of them. Great importance had been assigned to problems related to the quality of the data base used in the evaluation of each substance or group of substances as well as to ecotoxicological aspects. A summary of the report of the Working Group is attached as Annex IV.

2.2 Estimation of fish consumption patterns as a basis for assessing the dietary route of exposure to harmful substances was one of the crucial tasks of the Working Group. In the discussion of different approaches to this task the Group reviewed the advantages and disadvantages of two principally

different methods, viz. the estimation of percentiles of the average fish consumption and the critical group concept as used in radiation protection. The Working Group was invited to seek advice on the latter approach from the International Commission on Radiation Protection (ICRP).

2.3 The Group then discussed the documents containing the review of arsenic, mercury and selenium. The document on the evaluation of arsenic was accepted as drafted. As concerns the mercury document, the discussion focussed on the high levels of mercury concentration recorded in the open oceans which, it was considered, may be inaccurate. One member of the Group offered to provide recent references together with his comments on this subject to the Working Group for inclusion in the final version of this section. Discussion of the selenium document highlighted the importance of excessive as well as deficient levels, and also the mercury-selenium interaction.

2.4 The Group, after discussion, approved the documents on arsenic, mercury and selenium to be published as a combined report in the series of GESAMP Reports and Studies as No. 28. Further editorial comments and points for clarification should be provided to the WHO Technical Secretary to be duly taken into account in the finalization of the document. Authorship of the various draft sections could be recognized jointly in an acknowledgement. Special attention should be given to the lay-out and possible illustrative material to improve the presentation of the document. A list of contents of GESAMP Reports and Studies No.28 is included in Annex IV to this report.

2.5 In discussing the draft review of organosilicons the Group noted the difficulties which the Working Group has had with the open-ended nature of organosilicons as a chemical classification. It was considered realistic to limit the evaluation to certain specific sub-groups, notably silanes and siloxanes, which are at present of commercial significance. The Group also noted with concern the scarcity of the ecotoxicological data base and that this has been established mainly by the organosilicon manufacturing industry. The Group concurred, however, that the review be completed in spite of these limitations, and that the final report should clearly spell these out.

2.6 Members of the Group prepared a supplementary statement in the conclusions section of the organosilicon document which summarizes the above reservations and which is based on the initial findings of the Working Group as already stated at the fourteenth session of GESAMP (GESAMP Reports and Studies No.21, paragraphs 2.6 and 2.7). With this amendment and a shortened introductory section the Group approved this review document for publication in the series of GESAMP Reports and Studies as No. 29. A list of contents of this document is set out in Annex IV to this report.

2.7 The Chairman of the Working Group then introduced the results and recommendations made by two expert meetings (sub-groups) on carcinogens, including a recommendation that the organizations concerned consider, as a matter of urgency, the mobilization of the necessary support for the further development and acceleration of work on the impact of carcinogenic substances on marine organisms and their implications concerning public health and to place into perspective recent studies on DNA disruption and repair processes. The need for an in-depth review of the various aspects of the problem was stressed, an exercise which would stretch over at least three years and require substantial external funding. The Group was informed that a national research authority had expressed interest in the subject in light of its potential future implications, and that the support of other national or international institutions should be sought.

2.8 In the ensuing discussion the Group recognized the potential severity of the problem and also the diversity and complexity of the subject and its dual focus on the occurrence of tumours in fish as well as on human carcinogenicity in relation to seafood consumption. Further study within GESAMP of the subject of carcinogens in the marine environment should therefore focus on specific aspects which might be addressed sequentially. In the first instance, more emphasis may have to be put on aquatic organisms, whereas human intakes of carcinogens may be dealt with in a later phase. Also a selection of only few or a specific group of carcinogens may have to be made in the initial review process.

2.9 The Group was informed of the activities of an ICES expert group of fish pathologists who have considered the incidence of fish tumours in the North Sea. Liaison between the Working Group and the relevant ICES experts was advocated, as well as the inclusion of marine biologists with experience on fish tumours in the GESAMP Working Group. Co-operation should also be developed with the GESAMP Working Group on the State of the Marine Environment.

2.10 In light of the Group's observations and suggestions the Chairman of the Working Group proposed to critically review the recommendations of the two meetings of the sub-group of experts held so far, with particular regard to possible future activities within the framework of GESAMP and its Working Group on the Review of Potentially Harmful Substances. He also offered to explore the interest of other organizations in this respect and the feasibility of external support. He undertook to submit a proposal for the future work related to the evaluation of carcinogens to the next session of GESAMP.

2.11 The review of nutrients, phosphorus and nitrogen was also one of the activities initiated earlier by the Working Group but not pursued further during the intersessional period. The Group was nevertheless provided with some background information in the form of a preliminary expert review paper on the evaluation of nutrients and algal blooms. In addition, the Unesco Technical Secretary submitted a paper to the Group which outlined the growing concern over the eutrophication of coastal waters and observed changes in related ecosystems, as well as the need for GESAMP to deal with this problem.

2.12 The Group, in discussing these two papers, in principle shared the views expressed in both of them and confirmed the serious concern over eutrophication as an aggravating phenomenon of increasingly widespread occurrence. Causative linkage to increased influx of nutrients from land-based sources was recognized although other factors were considered to be probably of equal importance.

2.13 The work undertaken so far within the framework of the Working Group on the Review of Potentially Harmful Substances was noted and the terms of reference of this working group considered adequate for a first review of the subject area. In light of the complex nature of eutrophication and algal blooms and their impact on marine/coastal ecosystems, however, the Group proposed that a separate working group on the subject be established. This approach would allow for discussion of new terms of reference, including specific aspects of the phenomena which were beyond the mere consideration of nutrients. Specific suggestions to this effect were made, including an expansion of the terms of reference for the existing working group.

2.14 Further discussion on this matter is reflected in Chapter 10 of this report (Future Work Programme).

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 held its eighteenth meeting during the intersessional period in London from 7 to 11 October 1985. He presented a short summary of the work that had been carried out, drawing attention to those issues which needed particular action or decision by the Group. In this connection the Group noted that there were still quite a number of substances carried by ships which have not yet been evaluated and that every day IMO receives requests for the evaluation of new substances proposed for carriage by ships. Thus the evaluation of the hazards of harmful substances carried by ships was a continuing task to be carried out by GESAMP. A summary of the report of the eighteenth meeting of the Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships is shown in Annex V.

3.2 The Chairman of the Working Group introduced the report of the intersessional work. He noted that the work of the Working Group in establishing guidelines for the assessment of taint in sea food had been used by the European Chemical Industry Ecology and Toxicology Centre (ECETOC) to prepare a draft protocol for the assessment of the ability of a chemical to cause taint, and that a series of tests were currently being undertaken in respect of four substances selected for validating the protocol. These chemicals represent a range of tainting potentials. The Working Group looked forward to the completion of this work which would materially assist it in finalizing its guidelines for the assessment of taint.

3.3 The Group noted that all substances evaluated so far by the Working Group had been screened with regard to their effects on reproductive systems and teratogenic effects. Where necessary such effects have been recorded in the remarks column of hazard profiles.

3.4 With regard to the evaluation of substances of low density, high volatility and low solubility, the Chairman reported that because such materials might be rapidly removed from the marine environment, this did not indicate that there was no harm to marine species. Tests carried out with Low Aromatic White Spirit (LAWS) had indicated that damage to test animals ultimately leading to mortality accrued at an early stage of exposure. In light of a number of enquiries by the chemical industry concerning the appropriateness of the test procedures used by the Working Group in evaluating such substances, the Working Group had emphasized the need to use LC₅₀ values obtained by recognized procedures such as those described in the OECD Guidelines for the testing of chemicals. These require the exposure of the test organisms to known concentrations of the substance for certain fixed periods of time. LC₅₀ values obtained by such testing should be regarded as intrinsic properties of the substances concerned. Such results might in a few cases not reflect what might occur in an actual spill at sea or when tank residues from ships were discharged into the sea. However, it was considered to be the task of the responsible IMO bodies to take such matters into account when developing shipping requirements on the basis of GESAMP hazard profiles, rather than of GESAMP itself.

3.5 With regard to the evaluation of mixtures, the Working Group had noted that it would be impractical to test every formulation. The Working Group was sympathetic to the grouping of the components into classes which can be chemically described and which would have similar effects. Further

information was however required before the Working Group could proceed further, especially on chemical structures and properties, and on eco- and mammalian toxicology. The Working Group had agreed to look in greater detail at two of the classes proposed when this information had been provided.

3.6 In discussion, attention was drawn to the hazard profiles, some of which were incomplete. The Chairman of the Working Group reiterated the comment made at the fifteenth session of GESAMP which noted the difficulties in obtaining relevant data for the evaluation of hazards of certain substances, particularly on their aquatic toxicity. The Group noted that due to the efforts made by the IMO Technical Secretary in developing close co-operation between the Working Group and IMO bodies, national maritime administrations and chemical manufacturers' associations, the situation is continuously improving.

3.7 A number of comments were made on those columns of the hazard profiles which indicated hazards to human health. It was argued that the hazard profiles in this respect did not reflect all the circumstances and conditions under which the background data have been obtained and accordingly presented only a very rough estimate of the true situation. In response the Chairman of the Working Group pointed out that detailed information on how the hazard profiles are being established was given in GESAMP Reports and Studies No.17. He also emphasized that the hazard profiles have been established to develop various shipping requirements and should not be applied for any other purpose. The attention of the Group was drawn to the Introduction to the IMO Composite List of Hazard Profiles which contained wording to this end.

3.8 In approving the report, the Group adopted the hazard profiles revised and completed by the Working Group, noted the ongoing discussion concerning the evaluation of mixtures and confirmed the views of the Working Group concerning the use of established, recognized test procedures (such as those given in the OECD Guidelines) for substances of low density, high volatility and low solubility.

3.9 The Group also approved the future work programme of the Working Group as follows:

- .1 the continued evaluation of the hazards of substances carried by ships or proposed for inclusion in the relevant IMO Codes;
- .2 the review and updating of GESAMP Reports and Studies No.17 with a view to the preparation and publication of a revised version;
- .3 the finalization of the tainting guidelines on the basis of results from tainting tests;
- .4 the detailed consideration of proposals related to the carriage of mixtures at sea;
- .5 the revision of profiles of alkanes and carboxylic acids;
- .6 the consideration of a review of the problems associated with those compounds in homologous series that are of high toxicity but low solubility (examples include alkanes, alkenes, carboxylic acids, alcohols and alkylbenzenes);
- .7 the review and updating of data sheets;

.8 the review of the whole composite list with respect to carcinogenicity, teratogenicity, reproductive effects and sensitization; and

.9 the establishment of a computerized data base.

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

4.1 The WMO Technical Secretary informed the Group that the sixth session of the Working Group had been held in Paris, France from 6 to 9 January 1986. The session was mainly devoted to consideration of the first two tasks of the terms of reference approved by the fifteenth session of GESAMP (GESAMP Reports and Studies No.25, paragraph 4.5). The Working Group had also discussed the effects of contaminants in modification of physical, chemical and biological processes in the troposphere, at the air-sea interface and in the sea. It had prepared a statement on process modification by pollutants requested by the twelfth and fifteenth sessions of GESAMP. The Group was reminded that this request had arisen from a preliminary proposal of the Working Group to amend the GESAMP definition of marine pollution to take into account possible effects of pollutants on ocean-related physical processes, especially those pertinent to climate. Having considered this matter, the Working Group postponed any decision concerning the changing of the GESAMP definition of marine pollution.

4.2 In the absence of the Chairman of the Working Group, the report of its sixth session was presented by the Rapporteur of that session. The effect of atmospheric carbon dioxide increase on climatic change had been reviewed by the Working Group. In particular the role of the global ocean in influencing the magnitude and variations of tropospheric carbon dioxide concentrations, the knowledge of which is indispensable for modelling and predicting any resulting climatic changes and anomalies, had been discussed. Some trace gases and aerosols were also considered in terms of climatic changes, as well as the chemistry and physics of the atmosphere-ocean boundary layer and their effect on air-sea exchange of substances. The importance of surface films in air-sea exchange was emphasized, and it was noted that their physico-chemical characteristics can greatly influence this exchange. The potential of remote sensing for making measurements of sea-surface phenomena, e.g. slicks, ripples, and of phytoplankton abundance, was briefly discussed.

4.3 The Group noted that the Working Group had clearly demonstrated the complexity of the problem of pollutant modification of atmosphere and ocean-related processes and their possible effect on climate. The appropriateness of such studies within GESAMP was confirmed by the Group.

4.4 The Group expressed concern about the adequacy of reliable data on fluxes of carbon dioxide and some other gases between the atmosphere and the oceans on which most models were based. The difficulties in development and application of appropriate sampling and analytical techniques, and the possibility of spurious results from sampling and analytical errors were mentioned in this respect.

4.5 The opinion was expressed by some members of the Group that processes of carbon dioxide uptake and removal in the ocean should be given more consideration to better understand the role of the ocean as a sink for carbon dioxide. It was stressed that greater attention should be paid to certain trace gases such as chlorofluorocarbons and hydrocarbons, nitrous oxide, ozone

and others in the assessment of the "greenhouse" warming. In this connection it was mentioned that by the mid-1990s a temperature increase of 0.25-0.30°C could be reached from the combined effect of carbon dioxide and those other trace gases. This increase could be measured above background fluctuations. The question was asked whether it would be possible to verify the present model predictions and assumptions on the basis of this potential near-term temperature increase.

4.6 One member of the Group noted a deficiency in the report in that the role of marine sediments as a sink for carbon dioxide was not taken fully into account. He offered to provide references to recent publications.

4.7 Another member raised the question that the report submitted by the Working Group dealt with potential effects of constituents which may not necessarily be pollutants and that this matter might be to some extent beyond the scope of GESAMP.

4.8 The need for the Working Group to continue making efforts towards assessing atmospheric transport of pollutants into specific regions was reaffirmed by the Group.

4.9 The Group endorsed the report in principle and recommended that the Working Group should continue its work during the intersessional period under the terms of reference adopted at the fifteenth session of GESAMP and that it should present a more complete and updated report at that session. The members of the Group were requested to send their comments on the report to the WMO Technical Secretary.

4.10 A summary of the report of the sixth session of the Working Group on the Interchange of Pollutants between the Atmosphere and the Oceans is shown at Annex VI.

5 LAND-SEA BOUNDARY FLUX OF POLLUTANTS (Working Group 22)

5.1 The Unesco Technical Secretary informed the Group that the Working Group had held its first full scale meeting in Roscoff, France, from 8 to 12 July 1985. It was noted that the progress report presented to the Group had originally been produced at the Roscoff meeting, but had been subsequently elaborated on intersessionally and completed during an editorial meeting at the Skidaway Institute of Oceanography in January 1986. The Unesco Technical Secretary reminded the Group of the Terms of Reference of the Working Group (GESAMP Reports and Studies No.18, paragraph 10.1), noting that the substantial scientific information summarized in the report mainly addressed the first and second Terms of Reference.

5.2 At its meeting in Roscoff the Working Group identified the work required for the completion of its task, following which the Chairman took the initial step of soliciting inputs from selected members. Several limited-size case studies would be examined, one specific case being considered at the IOC Workshop on Riverine Inputs of Contaminants, Thailand, April-May 1986.

5.3 The aim was to compose a report during a core group meeting at the end of 1986 or early 1987 for adoption by the Group at its seventeenth session.

5.4 The Chairman of the Working Group introduced the scientific substance of the progress report and explained the approach adopted by the Working Group. Referring to specific matters addressed by the Working Group, he stated that

the Working Group had agreed on the method of carrying out the work, including considerations of hydrological factors, definitions of the upstream and coastal zone-open ocean boundaries, and delineation of the basic processes involved in the salinity gradient transfer zone. The use of distribution coefficients in describing the partition between the dissolved and particulate phases of the suite of substances selected for consideration would be focussed on, so as to arrive at global estimates of gross and net fluxes for specific substances. He further emphasized that the Working Group is dealing with riverine inputs per se and was neither treating specific anthropogenic inputs nor specific inputs associated with islands and ground water transfer.

5.5 Extensive coverage of existing information on riverine inputs was being obtained through the use of a questionnaire approach for which a network of contacts had been developed with encouraging returns. The Chairman also stated that the Working Group had undertaken, inter alia, to define observations required to assess the flux and to make comparisons of the relative importance of river and atmospheric inputs (noting that this would partly depend on the characteristics of the substances considered) and to assess the quality of existing data to determine fluxes.

5.6 Several members of the Group commented on the progress report, generally expressing satisfaction with the approach, the substantive work so far accomplished, and the plans for its completion.

5.7 Some reservation was expressed as regards the approach being based on the use of distribution coefficients. It was acknowledged that this method could be used for some substances, that it was a simplified approach, and that difference in sources could be reflected in different values for the same fraction of particulates. The concern was particularly valid on a local scale. It was also realized that the assumptions inherent in the use of partition coefficients were not always fulfilled. It was emphasized that degradation of organic contaminants occurs along transport gradients, implying a spatial variation of the distribution coefficients. The difference between organic and inorganic substances in this respect was noted. The kinetics and dynamics of the system must be considered for specific substances as appropriate. The opinion was expressed that partition coefficients can be used for hydrophobic type substances; for others only with great reservation.

5.8 The Group noted the necessity of taking the range of heterogeneity into account as manifested in different mixing ratios in estuarine and coastal zones. It was acknowledged that stratified conditions often prevail and that these need proper consideration.

5.9 The Group realized that the Working Group was addressing only river inputs and that these were not sufficient to judge all land-based sources of contaminant input to the sea. It was further noted that the Working Group had realized this, but would refrain from considering anything but river inputs due to the need to focus on an attainable objective and the requirement for a reasonably coherent approach.

5.10 A question was raised concerning the coverage obtained through the questionnaire, the quality control of the information given, and the possibility of using the established networks of contacts for other but similar purposes. It was recognized that quality control could be achieved partly by identifying patterns of similarity on regional and global scales. It was acknowledged that the coverage was rather good and that the part of the network consisting of oceanographic institutions could also be used for other

similar purposes. Nevertheless to increase coverage all sponsoring agencies were invited to distribute the questionnaire to their focal points. The questionnaire was not being revised at this stage.

5.11 Information was given that UNEP, with WHO as the leading organization and in co-operation with other relevant UN organizations, was in the process of preparing a survey of land-based sources and amounts of pollutants reaching the Mediterranean Sea. This survey, which should be accomplished by the end of 1986, would improve and update a similar exercise performed in 1977. Information gathered, particularly on contaminants entering the Mediterranean Sea through rivers, might be of interest to the Working Group on Land-Sea Boundary Flux of Pollutants.

5.12 The Chairman of the Working Group acknowledged the comments made, stated that they would be taken into account to the extent possible, and solicited further comments in writing from the experts.

5.13 The Chairman of the Group concluded that the opinions expressed showed the satisfaction of GESAMP with the progress made, that endorsement was given to the further schedule and work programme, and that GESAMP expected to see a report presented at its seventeenth session for possible final adoption.

5.14 A summary of the report of the meeting of the Working Group on Land-Sea Boundary Flux of Pollutants is shown in Annex VII.

6 METHODOLOGY AND GUIDELINES FOR THE ASSESSMENT OF THE IMPACT OF POLLUTANTS ON THE MARINE ENVIRONMENT (Working Group 23)

6.1 The FAO Technical Secretary informed the Group that the Working Group had held its third session in Rome from 23 to 27 September 1985. He recalled that at the fifteenth session of GESAMP the main body of the report of the Working Group had been endorsed, thus supporting the approach taken. It had been requested that a number of case studies be attached to the report to verify the applicability of the environmental capacity concept in preventing marine pollution, and to give guidance to users on how to apply this concept in practice. The FAO Technical Secretary expressed the view that these tasks had been completed by the Working Group. The report was subsequently introduced by the Chairman of the Working Group.

6.2 The UNEP Technical Secretary recalled that the Working Group had been established at the request of UNEP during the thirteenth session of GESAMP. UNEP as the organization providing the Secretariat for several regional marine pollution control conventions, required guidelines for the assessment of the waste receiving capacity of the marine environment and of the environmental impact of pollution on the marine and coastal environment, which could be used in the implementation of the regional conventions, particularly in developing countries. Consequently, the Working Group had been expressly asked to "concentrate on providing practical advice to developing countries". He expressed the view that the report as presented although being a valid scientific document, does not fully meet UNEP's needs for practical guidelines applicable in the context of the regional conventions for which UNEP acts as the Secretariat.

6.3 It was explained that the Working Group, although fully aware of its specific terms of reference, did not feel able to prepare more simplified instructions on how to calculate the waste receiving capacity of the marine environment, in view of the complexity and uniqueness of each receiving

environment. While the report clearly states the validity of the approach to use the strategy based on the environmental capacity for the disposal of wastes, the examples provided would help to give general directions on how to proceed in principle.

6.4 The report was discussed extensively by members of the Group, and specific comments were made on the need to improve on some of the examples given for the application of the environmental capacity concept. In response to reservations expressed concerning the treatment of the interaction between scientific advice and the decision process, a proposal was made to clarify this aspect, including socio-economic considerations. The majority felt that the report in its present form was a valuable contribution to the work of GESAMP and would constitute a step in the right direction, although the calculation of the environmental capacity still faces several sources of uncertainties in quantifying some of the parameters which have been addressed in the report by the use of probabilistic techniques. One problem was the identification of targets which would ensure adequate protection of an ecosystem. It was, however, noted that the process as proposed by the Working Group provides for ample safety margins, e.g. through the introduction of safety factors in defining water quality criteria. The introduction of mandatory monitoring of effects of the discharge of wastes to the marine environment and the recommended reassessment procedures would ensure that corrective measures can be taken if necessary.

6.5 It was concluded that specific proposals for amendments to the report should be handed in before the end of the session to the FAO Technical Secretary who would undertake, jointly with the Chairman and the Rapporteur of the Working Group, to incorporate them into the revised Report, which would subsequently be circulated among the members of GESAMP. Subject to this condition the report was approved for publication as GESAMP Reports and Studies No.30. A summary of the report together with a list of contents as well as a list of contributors is contained in Annex VIII.

7 INTEGRATED GLOBAL OCEAN MONITORING (IGOM) (Working Group 24)

7.1 The UNEP Technical Secretary briefly reviewed the history of the Working Group since its establishment at the fourteenth session of GESAMP. He informed the Group that the first meeting of the Working Group had been held in Batumi, USSR, from 2 to 5 December 1985. Eleven experts, two observers and two GESAMP Technical Secretaries (UNEP and WMO) participated in the meeting.

7.2 The Chairman of the Working Group introduced the report of the Working Group and highlighted its main conclusions and recommendations.

7.3 The Unesco Technical Secretary introduced a note on IOC Global Investigation of Pollution in the Marine Environment (GIPME) with reference to integrated global ocean monitoring. He drew the attention of the Group to the possibility of co-operation between GIPME and the GESAMP Working Group, in particular to the possibility of using GIPME as a mechanism for the implementation of the integrated global ocean monitoring (IGOM) programme.

7.4 In the ensuing discussion the following comments and suggestions were made:

- .1 the Working Group had not fully taken into account many of the available documents describing programmes and approaches relevant to IGOM;

- .2 the aims of IGOM, as defined in the report, seemed too ambitious and over-optimistic as to their feasibility; they may require closer definition and justification;
- .3 the Working Group in its future work should concentrate on providing better justification for IGOM and should consider the other items of its terms of reference as of secondary importance;
- .4 the need for open ocean baseline data against which the future changes could be compared and the present unpredictability of ecological changes as well as low-level persistent contamination in some areas of the ocean may be among the best justifications for IGOM;
- .5 extrapolation from coastal research and monitoring programmes may be more difficult than it seems;
- .6 the sampling and analytical techniques available today may not be applicable and useful for all variables proposed to be used in the context of IGOM;
- .7 the importance of boundary fluxes in IGOM should be given greater recognition;
- .8 the applicability of remote sensing techniques for IGOM may be overrated although the advantages of these techniques have been recognized for certain biological parameters;
- .9 the assumption that the levels of contaminants are regularly higher in coastal waters than in open ocean may not necessarily be true;
- .10 the knowledge about processes governing the fate and determining the effect of pollutants in open oceans may be better than in coastal waters due to the complexity of the situation in the latter;
- .11 the usefulness and global applicability of "mussel-watch" type of monitoring should be better documented;
- .12 the inclusion of sea bottom monitoring in IGOM would need to be justified;
- .13 due to the long residence time of some contaminants in open oceans, irreversible changes may have already occurred in open ocean in respect of such contaminants;
- .14 intercalibration of sampling and analytical techniques and quality control of data should be mandatory for all participants in IGOM;
- .15 stress on biological variables in IGOM is justifiable since previous similar proposals did not include them adequately.

7.5 The Unesco and UNEP Technical Secretaries clarified the role of the Working Group in relation to the IOC Global Investigation of Pollution in the Marine Environment (GIPME) and to UNEP Earthwatch and the Global Environment Monitoring System (GEMS) in particular.

7.6 Taking into account the status of the report submitted by the Working Group and the comments and suggestions made by the members of the Group at this session, as well as the information provided by the Technical Secretaries of UNEP and Unesco, the Group decided that the Working Group should continue its activity and report to the next session of GESAMP. It was also agreed that the present report of the Working Group will be reviewed by the forthcoming meeting of GIPME (September 1986) together with the comments and suggestions offered by the Group at this session, and that the Chairman of GIPME will be invited to join the Working Group as a member. The Unesco Technical Secretary informed the Group that Unesco will join the Working Group as co-operating agency.

7.7 A summary of the report of the Working Group on Integrated Global Ocean Monitoring is shown at Annex IX.

8 COASTAL MODELLING (Working Group 25)

8.1 The IAEA Secretariat introduced the report of the first meeting of the Working Group on Coastal Modelling which had been established by GESAMP at its fifteenth session. The meeting had been held in Vienna, from 27 to 31 January 1986. A summary of the report is shown in Annex X. The Chairman of the Working Group sought guidance from GESAMP members on three matters raised in the meeting report:

- .1 the modified terms of reference;
- .2 the conceptual model as set out in the meeting report; and
- .3 the proposed outline of the final report.

8.2 Discussion of these items resulted in the following actions:

- .1 the modified terms of reference as stated in the meeting report were adopted;
- .2 the term "regeneration" as used in the conceptual model was changed to "release" as several members thought that this term more accurately described the transfer of material from biota to water; and
- .3 there were no substantive comments on the proposed report outline. It was suggested that GESAMP members submit comments later in writing to the IAEA Secretariat.

8.3 Several GESAMP members expressed interest in coastal modelling and wished to be kept informed as tasks of the Working Group proceeded. One member suggested that modellers from Belgium would provide valuable input to the work of the Group. The Chairman of the Working Group said that he was aware of the work being conducted by Belgian oceanographers and would seek ways in which their work and experience might be made available to the Working Group.

9 STATE OF THE MARINE ENVIRONMENT (Working Group 26)

9.1 The UNEP Technical Secretary introduced the report of the second meeting of the Core Group of GESAMP Working Group 26 on the State of the Marine Environment. The terms of reference of this Working Group had been set out in the Report of the fifteenth session of GESAMP (Reports and Studies No.25,