Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC/IAEA/UNEP Group of Experts on Standards and Reference Materials (GESREM)

Second Session

Halifax, Canada, 22-25 January 1990

UNESCO

In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of «El Niño» *(Also printed in Spanish)*
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping *(Also printed in French and Spanish)*
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica *(Spanish only)*
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
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26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities *(Also printed in Spanish)*
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
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43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
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45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean
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55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
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59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials

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IOC-IAEA-UNEP/GESREM-II/3
Paris, 12 May 1991
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1. OPENING OF THE SESSION

1 The Chairman of the Group of Experts on Standards and Reference Materials (GESREM), Dr. W.D. Jamieson, opened the Session at 0930 hours, on 22 January 1990 and welcomed members and observers to the Second Session of the Group.

2 The Assistant Director of the Atlantic Research Laboratory, Dr. John van der Meer, welcomed the participants.

3 The Technical Secretary, Dr. A. Boussoulengas, welcomed the participants on behalf of IOC. He thanked the Director of the Atlantic Research Laboratory, Dr. R.A. Foxall, of the National Research Council of Canada, for his kind invitation to host the Second Session of GESREM. He also expressed his appreciation to the Chairman, Dr. W.D. Jamieson, who initiated the idea for holding the meeting at Halifax and made the necessary technical arrangements. He noted the importance attached by IOC to the development by the Group of practical ways to respond to the needs for standards and reference materials by international programmes.

4 Dr. A. Walton welcomed the participants on behalf of IAEA and stressed that the co-sponsoring Agencies would like to see the work of GESREM developing strongly in the future.

5 Dr. M. Gerges welcomed the participants on behalf of UNEP. Emphasizing the importance attached to the work of the Group by the Oceans and Coastal Areas Programme, Dr. Gerges expressed the hope that the present session would agree on modalities for the production of necessary reference materials and advise on suitable procedures for making them available to participants in the Regional Seas Programme worldwide.

6 The Chairman briefly introduced the participants. He explained that since the Halifax-Dartmouth area is a major centre for Oceanography for Canada, being the site of Bedford Institute of Oceanography, Dalhousie University and Atlantic Research Laboratory, observers from those institutions would join the meeting. The List of Participants is given in Annex III.

2. ADMINISTRATIVE ARRANGEMENTS

2.1 ADOPTION OF THE AGENDA

7 The Group adopted the Agenda (Annex I).

2.2 DESIGNATION OF RAPPORTEUR

8 Dr. F. Culkin, who had also acted as Rapporteur at the First Session of GESREM, was designated as Rapporteur for the Session.

2.3 CONDUCT OF THE SESSION

9 The Technical Secretary introduced the documentation. He explained that participants were requested by the invitation letter to bring to the Session working or information documents. These documents were distributed during the Session.

3. REPORT ON INTERSESSIONAL ACTIVITIES

10 The Chairman asked the participants to report on their intersessional activities during the discussion of Agenda Items 4 and 5. He noted that a major intersessional activity has been the update of the "Catalogue of Standards and Reference Materials for Marine Science" which was prepared by Dr. A. Cantillo, working with U.S. NOAA.

11 The Technical Secretary introduced Document IOC-IAEA-UNEP/GGE(SRM)-II/6 presenting an overview of intersessional activities within the GIPME Programme. He pointed out the close cooperation of IOC with UNEP and IAEA in the development and implementation of regional marine pollution research and monitoring programmes. He also noted that the Report of the Fourth Session of GIPME Officers (Paris, 2 - 4 March, 1988) made reference to recommendations by the First Session of GESREM and relevant tasks, and provided advice for their accomplishment.

12 The Chairman referred to his attendance intersessionally at two sessions of GEMSI and the First JGOFS Planning Meeting in the Hague, September 1988.

4. REPORTS FROM USERS AND EXPERT GROUPS ON THEIR EXPERIENCES WITH THE USE OF REFERENCE MATERIALS AND ON THEIR NEEDS FOR REFERENCE MATERIALS

4.1 OCEAN AND COASTAL AREAS PROGRAMME (UNEP)

13 Dr. M. Gerges and Dr. L. Mee introduced Document IOC-IAEA-UNEP/GGE(SRM)-II/7, which reviews the accomplishments and objectives of GESREM and makes proposals for developing its role. The Group, bearing in mind the GESREM mandate to plan the long-term development of marine analytical chemistry reference materials, decided there should be intersessional action to define the requirements of the sponsoring agencies, recommend priorities and estimate the resources needed. Discussion on the recommendations proposed in this document was deferred to Agenda Item 8.

4.2 GROUP OF EXPERTS ON METHODS, STANDARDS AND INTERCALIBRATION (GEMSI)

14 The Vice-Chairman of GEMSI, Dr. M. Bewers, referred to two major activities currently being conducted by GEMSI: the Open-Ocean Baseline Study to be introduced by Dr. P. Yeats, and the Workshop on the Use of Sediments in Marine Pollution Research and Monitoring, which is scheduled to take place in Dalian, China, in April 1990. The latter workshop is intended to provide a vehicle for training and for testing sediment normalization techniques in a relatively unsurveyed area.

15 The Chairman of GESREM attended the 9th Session of GEMSI in Villefranche in December 1988, at which requirements for reference materials were discussed. Specific needs for reference materials referred to by GEMSI were: a water reference material for dissolved mercury; a calcareous marine (coastal) sediment reference material; and a pelagic clay sediment reference material. At a more strategic level, GEMSI flagged the following areas that required increased investment in the development of reference materials: dissolved/dispersed trace organic compounds, especially chlorinated compounds; and reaction products of organic substances, particularly photochemical and biochemical degradation products of hydrocarbons. In this connection, GEMSI also reiterated the necessity of reporting both the presence and absence of individual PCB isomers as this information would aid in assessing the relative reactivities of the congeners and the toxicological significance of PCB mixtures. Finally, GEMSI had noted that the development of Reference Methods for application in Ocean and Coastal Areas Programme of UNEP would result in needs for internal standards and reference materials.

4.3 OPEN-OCEAN BASELINE STUDY

16 Dr. P. Yeats introduced the IOC/GEMSI Open-Ocean Baseline Study, which is planned to determine background (baseline) distributions of contaminants in waters of the Atlantic Ocean. Studies will be carried out of (a) ambient concentrations in the major water masses of the Atlantic, and (b) seasonal variability on sections across the major ocean current systems. Trace metals of interest are Cu, Zn, Pb, Cd, Hg, Al, Fe, Mn, Co, Ni and Se. Salinity, temperature, dissolved oxygen and nutrients will also be measured.

17 The participants in this experiment will obviously need to use CRMs and general quality assurance procedures. Some intercalibrations will probably also be needed. Several of the trace metal laboratories have been involved in the various ICES/IOC intercalibration exercises to date, and the experiment makes use of the results of the sampling intercomparisons. In addition, appropriate CRMs are available for most of the metals of interest. Hg is the major exception. No reference seawater sample is available as yet. A low level Hg CRM would definitely be useful. There may also be a need for some uncertified samples (intercalibration samples) for all the metals as the second part of the experiment gets going, since a large number of laboratories are expected to be involved, including some from less developed areas. The organics situation is not as good. At the moment, participation is minimal - partly because of an inability of the organochlorine people to agree on results. The development of seawater reference materials for these organics will not be easy, but a start on the development of these should be made. Onus to start this development should perhaps fall to the researchers making the measurements, and should consider how to approach this problem. It is not yet clear that this is, at present, more than a research problem.

4.4 INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (ICES)

18 The Representative of ICES, Dr. M. Bewers, referred to the wide interest in GESREM work by several ICES Working Groups (on Marine Chemistry, on Sediments, on Environmental Assessments and Monitoring Strategies, on Statistical Aspects of Trend Monitoring and on Environmental Impacts of Mariculture, on Effects of Pollutants on Fish Stocks, et al). Several ICES Marine Chemistry Working Group activities are relevant to GESREM. There has been a considerable effort at developing quality assurance procedures and good laboratory practices for the ICES member laboratories and ensuring that they are used in the Joint Monitoring Group laboratories. More recently, these activities have ventured into trying to apply these principles to the sampling procedures. ICES has sponsored a three-year baseline survey of metals in "ICES" waters - essentially in the North sea and adjacent seas. A preliminary data evaluation shows good agreement for Pb and Cd where results seem to be agreeing to within about ±20%. This seems to be a good illustration of the improvements in trace metal work that can be attributed, at least in part, to the efforts devoted to intercalibrations, QA and CRMs.

19 Disagreements over nutrient results in several experiments would indicate a need for reference materials for coastal water nutrient studies.

20 The ICES Working Group on Marine Sediments (WGMS) is assisting with the first phase of the joint ICES/IOC intercomparison exercise for chlorobiphenyls. Once this phase is completed successfully, the WGMS will conduct a second phase based on a sediment or sediment extract. The U.S. NOAA with the aid of NIST has agreed to conduct this intercomparison. The first phase of an intercomparison exercise for trace metals in suspended particulate matter also has been organized by the WGMS. In the first phase of this exercise, being conducted by the Norwegian Institute of Environmental Protection, small quantities of a sediment were distributed to participants to test their ability to deal with small sample sizes. At the next meeting, the WGMS will evaluate results and consider the next step.

21 From an ICES perspective, the following appear to constitute the most important needs for the development of additional marine reference materials:

(i) a certified reference seawater sample for dissolved mercury;

(ii) certified reference seawater samples for nutrients (nitrate, phosphate and silicate, and, if possible, nitrite); and

(iii) certified reference materials for organochlorines, especially polychlorinated biphenyls, in fish tissues, sediments and seawater.

22 The first of these demands is being dealt with under the NRC Marine Analytical Chemistry Standards Program (MACSP). The second is relatively urgent in the context of current eutrophication

concerns and is likely to be possible to satisfy demands, following feasibility evaluations. The third is more of a demand at the strategic level for far better characterized marine materials certified for chlorinated organic compounds.

23 There is also a continuing need for uncertified homogeneous research materials to facilitate inter-laboratory quality assurance activities. However, this is currently less urgent than the three demands listed above.

4.5 JOINT GLOBAL OCEAN FLUX STUDY (JGOFS)

24 The Executive Secretary of SCOR, Mrs. E. Tidmarsh, reviewed the background to the establishment, in 1987, and the objectives of JGOFS, the central aim of which is to understand the ocean's role in the uptake and storage of CO_2, especially the anthropogenic CO_2 produced by burning of fossil fuels. The first of the JGOFS Process Studies took place during the 1989 North Atlantic field season and involved six vessels from five countries. A study was carried out of the evolution of the spring phytoplankton bloom and associated phenomena as it progressed Northward from 33° to 72° North along the 20°C West meridian. A period of follow-up activities in 1990 includes a major data workshop and an international science symposium in the meantime, planning is progressing for the second process study in the equatorial Pacific Ocean.

25 Standard and reference material requirements include those for the study of the CO_2 system and the nutrients phosphate, silicate, nitrate, nitrite and ammonia.

26 Dr. D. Repeta presented the work of Working Group 78 of SCOR (Document IOC-IAEA-UNEP/GGE(SRM)/INF-2). Dr. R. Bidigare and Dr. M. Kennicutt presented their work on the production of pigment standards for the use of JGOFS and other major oceanographic programmes. Interest was expressed by the Group on the preparation and availability of pigment standards. Dr. J. Winters commented on support on the preparation of standards which may be provided by EPA.

4.6 WORLD OCEAN CIRCULATION EXPERIMENT (WOCE)

27 Dr. A. Clarke gave an overview of the WOCE Programme. He referred to the programme's needs for standards and reference materials. He stressed that the WOCE scientific community expect producer organizations and networks to provide required standards for nutrients, freon, dissolved oxygen, ^{14}C, 228Ra and $^{3}He/^{3}H$.

28 Dr. F. Culkin pointed out that quantities of required standards could be a problem due to the enormous amount of measurements planned in the WOCE Programme.

29 Dr. L. Gordon referred to his laboratory's service to the WOCE Programme in providing reference materials for dissolved oxygen and nutrients analysis in seawater.

4.7 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

30 Dr. J. Calder presented the activities of NOAA.

31 Since 1984, the U.S. NOAA has conducted the National Status and Trends Program to determine the spatial and temporal variations in contaminant levels in sediments, bivalves and fish. The NRC (Canada) and U.S. NIST were retained to conduct quality assurance activities for trace metals and organics, respectively. A variety of sediment and tissue reference material were prepared for standardization and intercomparison purposes. Some of the reference materials developed for the NIST Program are now available for general use as certified reference materials.

32 Plans are being made to add measurement of parameters related to the problem of eutrophication to the National Status and Trends Program. Three standards will be required for dissolved

oxygen, pigments and inorganic nutrients. Other elements of NOAA are planning for an observation program related to the objectives of WOCE and JGOFS. Thus NOAA will have need for all of the standards identified above for those activities.

4.8 JOINT SCOR-UNESCO-ICES-IAPSO PANEL ON OCEANOGRAPHIC TABLES AND STANDARDS (JPOTS)

33 The Chairman of the JPOTS Sub-Panel on Standards for Carbon Dioxide Measurements, Dr. A. Dickson, referred to the Sub-Panel's work (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-3), which covered two main areas:

(i) Coordination and assessment of work done towards preparing CO_2 standards for oceanographic measurements; and

(ii) Development of recommendations for the production and use of such standards.

34 Results of an intercomparison exercise demonstrated the need for Certified Reference Materials (CRMs) for CO_2 measurements in seawater (Annex VI).

35 The Sub-panel has proposed that an interim reference material based on natural seawater should be available in limited quantities by July 1990, i.e., at the start of the proposed decade-long global carbon dioxide programme under WOCE and JGOFS.

4.9 INTERNATIONAL MUSSEL WATCH

36 Dr. L. Mee reported on a recent meeting of the International Planning Committee (January 1990, Kingston, Jamaica), where the general planning and the raising of financial resources were reviewed. The programme is expected to be financed by NOAA, IOC and UNEP. The pilot phase will concentrate in the Caribbean and South America regions. If successful, it will be expanded into a world programme. It is planned that 200 samples will be collected in the Caribbean region. Some of the samples will be sent to international laboratories and some to national laboratories for analysis of chlorinated hydrocarbons (DDTs and PCBs). There would also be an effort to archive samples for future analytical work for determination of toxaphene and other contaminants.

37 A large effort will be dedicated to quality control. It is estimated that 20% of the total analytical effort will go to analysis of standards. The problem of sample stability over a long period of time may be considered by GESREM. Dr. Jamieson noted that, at NRC, stable homogenized biological tissue, including homogenized mussel tissue samples, are prepared and ready for use in regional programmes.

5. UPDATE BY PRODUCING AGENCIES AND LABORATORIES ON REFERENCE MATERIALS PREPARED SINCE THE FIRST SESSION OF GESREM AND ON MATERIALS PLANNED TO BE PREPARED IN BIENNIUM 1990/91

5.1 NATIONAL RESEARCH COUNCIL (CANADA)

38 Dr. W.D. Jamieson and Dr. J. McLaren described the work performed within the Marine Analytical Chemistry Standards Program (MACSP) by two NRCC laboratories, the Atlantic Research Laboratory and the Analytical Chemistry Section, NRCC Division of Chemistry (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-4).

5.2 NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (USA)

39 Dr. T. Gills provided an overview of work by NIST (formerly National Bureau of Standards) in the field of standards and reference materials. New SRM directions are toward materials

that will provide measurement traceability in the following areas:

(i) nutrients in food
(ii) metal speciation
(iii) bioavailability
(iv) instrument and system performance

40 Dr. Gills underlined that the producers should supply users with very clear and explicit certificates and provide them with guidance and advice on selecting appropriate SRMs. He provided a list of SRMs produced by NIST (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-5).

5.3 INTERNATIONAL LABORATORY OF MARINE RADIOACTIVITY (IAEA)

41 Dr. A. Walton provided an outline of the activities of the International Laboratory of Marine Radioactivity. He stressed that the field of reference materials for radionuclide analysis is a difficult one and he believed that not many laboratories in the world deal with this. Intercalibration exercises in marine radionuclide analysis are organized with 50-60 laboratories participating mainly from developing countries. Information on currently available materials and plans for future distribution of materials is given in Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-6.

42 Dr. L. Mee gave an overview of the activities of the Marine Environmental Studies Laboratory of ILMR in the field of heavy metals. Interlaboratory testing of pelagic sediment samples has been organized and a similar exercise with Venice lagoon mussel homogenate is in an advanced stage of planning.

43 Difficulties have been encountered in achieving acceptable analytical agreement in determinations of organochlorines in fish tissue. An interlaboratory test with tunafish homogenate has been organized. Interlaboratory testing for mussel homogenate and sediment is planned to follow the Venice lagoon mussel homogenate exercise.

5.4 ENVIRONMENTAL PROTECTION AGENCY (USA)

44 Dr. J. Winter provided an overview of activities of the U.S. Environmental Protection Agency in producing reference materials for environmental studies and noted some of the achievements of their Quality Assurance Programme.

45 New activities include the production of reference materials for the needs of new programmes such as Global Climate Change (air, water and hazardous waste), Total and Human Exposure Assessment, and Environmental Monitoring Assessment Programme; these are long-term strategic programmes; Quality Control samples are produced for studies in which the combination of organic contaminants is important (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-7).

46 A new activity within the Methods Programme is the use of bioassays, for which there is an increasing demand in regional programmes.

5.5 NATIONAL INSTITUTE OF ENVIRONMENTAL STUDIES (JAPAN)

47 Dr. Okamoto provided an outline of reference materials production by the National Institute for Environmental Studies of Japan. He noted that a mussel tissue reference material is used in monitoring programmes under WESTPAC. NIES has recently initiated a new programme for the preparation of biological and environmental reference materials for use in metal speciation studies (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-8).

5.6 NATIONAL SCIENCE FOUNDATION (USA)

48 Dr. J. Calder made reference to the U.S. NSF Programme, which may provide support, as appropriate, to scientific and academic institutions for research related to development of reference materials. Three research projects were introduced (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-9).

(i) A project at the Scripps Institution of Oceanography (Dr. A. Dickson), aiming at assessing the feasibility of preparing standard reference materials for the analysis of total inorganic carbon and total alkalinity in seawater.

(ii) A project at Oregon State University (Dr. L. Gordon) on the development of reference materials for dissolved oxygen and nutrient analysis in seawater.

(iii) A project at the Texas A&M University (Dr. R. Bidigare and Dr. M. Kennicutt) on Quality Assurance Procedures for the analysis of photosynthetic pigments and JGOFS intercalibration exercises.

5.7 NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION (USA)

49 Dr. J. Calder reviewed briefly projects supported by NOAA for the production of reference materials. The NIST has been supported by NOAA to prepare reference materials for organochlorine and aromatic hydrocarbons in sediment, tissue and solutions. The NIST, in turn, has made these materials available to the wider community through its SRM programme.

5.8 ISO COUNCIL COMMITTEE ON REFERENCE MATERIALS (REMCO)

50 Dr. M. Parkany reviewed the activities of the International Organization for Standardization.

51 The main activity of ISO is the preparation of International Standards in all fields (except the electrical one). Of particular interest to GESREM may be the work of ISO/TC 147 Water Quality and ISO/TC 47 Chemistry.

52 The most important committee in ISO for GESREM is the Council committee on Reference Materials, REMCO. In the ISO folder there is given literature on REMCO and also important ISO Guides (namely ISO Guides 30, 31, 33 and 35) which were prepared and accepted by the active cooperation with the most interested international and broadly based regional organizations. Comments on them, propositions, if any, will be taken into consideration by REMCO in the course of the revision of these Guides. In addition, REMCO may be informed on the activity and on the needs of GESREM (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF.10).

53 ISO publishes catalogues of international standards annually. It has also published, in 1982, a catalogue of certified reference materials. Plans are currently underway to computerize information on CRMs and update it semi-annually. Several members expressed interest in the work of REMCO and urged the continuation of exchange of information with GESREM.

5.9 IAPSO STANDARD SEAWATER SERVICE

54 Mr. P. Ridout reviewed the recent activities of the Standard Seawater Service (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-11).

55 With the approval of the International Association for the Physical Sciences of the Ocean (IAPSO) the responsibility of the operation of the Service was taken over by Ocean Scientific International Ltd. (OSIL) in April, 1989. The company has use of the same facilities and is operated by the same staff as previously.

56 The range of standard seawaters, certified in electrical conductivity ratio (K_{15}) and chlorinity, now available, comprises:

(i) P-Series, normalS = ca.35

(ii) 30L-Series, lowS = ca.30

(iii) 10L-Series, lowS = ca.10

57 The Group noted the important work of the IAPSO Standard Seawater Service and expressed the hope that funds can be found for the employment of an additional analyst to be trained in the necessary calibration techniques. This would help to ensure the future of this essential facility. Support was also expressed for the intention of the Service to provide advice on the correct procedures for standardization of laboratory salinometers with IAPSO Standard Seawater.

5.10 OTHERS

58 Dr. L. Gordon provided information on the work of his laboratory at Oregon State University in preparing reference materials for nutrients and dissolved oxygen analysis in seawater (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-9).

59 Dr. A. Dickson provided information on the work of his laboratory at Scripps Institution of Oceanography on the Status of reference materials for oceanic carbon dioxide measurements (Document IOC-IAEA-UNEP/GGE(SRM)-II/INF-9).

6. STATUS OF THE UPDATE OF THE CATALOGUE "STANDARD AND REFERENCE MATERIALS FOR MARINE SCIENCE"

60 Dr. A. Cantillo presented to the Group the second edition of the catalogue entitled ***Standard and Reference Materials for Marine Science*** (Document IOC-IAEA-UNEP/GGE(SRM)-II/8). It was originally compiled in 1986 for NOAA, and has been published as NOAA Technical Memorandum NOS OMA-51 (434pp, 1989). The catalogue lists more than 900 reference materials from thirteen producers. Source, description and preparation, analytes and values, cost, reference and comments are given for each reference material.

61 The reference material producers of the materials included in the second edition of the Catalogue are Analytisk Sporelement Komité (Norway; available through Referensmaterial AB); Community Bureau of Reference (EEC); International Atomic Energy Agency (Austria); Instituto de Pesquisas Tecnológicas (Brazil); Laboratory of the Government Chemist (United Kingdom); National Institute of Standards and Technology (USA); National Institute of Environmental Studies (Japan); National Research Council (Canada); Ocean Scientific International Ltd. (United Kingdom); Sagami Chemical Research Centre (Japan; available through Wako Chemical); South Africa Bureau of Standards (South Africa); U.S. environmental Protection Agency (USA); and U.S. Geological Survey (USA).

62 The types of reference materials included are ashes (including air particulate materials); gases; instrument performance materials (including calibration standards and single element/compound solutions); materials; rocks; sediments; sludges; tissues; an waters (natural and simulated).

63 Indices are included for elements, isotopes and organic compounds. Cross references to CAS registry numbers, and alternate names and chemical structures of organic compounds are also provided.

64 The Chairman and the representatives of UNEP, IOC and IAEA congratulated Dr. A. Cantillo for her excellent work. The representative of UNEP noted that he was sure that numerous laboratories involved in the regional seas programmes would be interested to have copies. The Technical

Secretary referred to the earlier planning and recommendations for the update of the catalogue and noted that IOC has planned to print a number of copies and distribute to IOC Action Addresses and other appropriate institutions. The representatives of IAEA and UNEP expressed also their interest to reprint the catalogue and distribute it to interested addresses under their programmes.

65 The Group was happy to hear about the offer by the co-sponsoring Agencies and agreed that IOC should reprint the catalogue. A discussion ensued on the need to keep updating the catalogue on a continuous basis. Dr. P. Stegnar stated that he was ready to provide to Dr. Cantillo information on institutions in Eastern European countries which are active in producing reference materials.

66 The Group considered that it is important that the catalogue be publicized and that a small introduction on the co-sponsorship of the UN Agencies should be prepared for that purpose.

7. DEVELOPMENT OF WORKPLAN AND IDENTIFICATION OF NEEDS FOR NEW SRMs AND STANDARDS AND DESIGNATION OF TASKS ON BASIS OF ALL NEEDS IN RELATION TO REGIONAL SEAS RESEARCH AND MONITORING PROGRAMME; USE OF REFERENCE METHOD ZERO

67 The Technical Secretary noted that it was expected by IOC and GIPME that during its Second Session the Group will agree on a workplan for intersessional action by GESREM to meet the needs for supplying standards and reference materials to regional and international marine research and monitoring programmes. He proposed that a small ad-hoc group be formed sessionally to prepare a draft workplan and submit it to the Group for discussion.

68 The Group discussed the need for a workplan to be drawn and decided to form a small ad-hoc group (J.M. Bewers, J. Calder and L. Mee) to draft and submit a workplan to the Group dealing with the following matters:

(i) identification of needs;

(ii) designation of tasks;

(iii) modalities of a mechanism for the supplying of SRMs to international research and monitoring programs;

(iv) assessments of required quantities of SRMs;

(v) feasibility of producing SRMs in the required quantities by various programmes;

(vi) categorizing SRMs according to needs; and

(vii) provision of manuals for methods of preparation of reference materials.

69 Dr. L. Mee introduced Document IOC-IAEA-UNEP/GGE(SRM)-II/9, "Reference Methods and Materials: A programme of comprehensive support for regional and global marine pollution assessment". (Zero is a provisional number since the Reference Method document is still a draft.) He described the wider aspects of this cooperative programme as a joint UNEP/IAEA/IOC activity, and outlined the involvement of GESREM in it, particularly with respect to the Quality Control Component of the programme. The Group briefly reviewed the document and found it generally acceptable and recommended its wide distribution to the international community of users of Reference Materials in the regional and global marine pollution monitoring programmes.

8. RECOMMENDATIONS AND ACTION ITEMS

70 The Group discussed the recommendations proposed in Document IOC-IAEA-UNEP/GGE(SRM)-II/7 and, having considered important work reported to GESREM-II under Agenda Items 4, 5 and 6, decided the following on each specific proposed recommendation:

The Group:

(i) offered to widen its mandate to include all aspects of Quality Control and, together with GEMSI, formulate strategies for implementing QA procedures in regional and global marine pollution monitoring programmes;

(ii) offered to develop, intersessionally, detailed recommendations about the organic contaminants and matrices most urgently needed, and also try to develop a collaborative project in which several members would cooperate in the development and production of a marine tissue (probably bivalve) reference material for the determination of organic contaminants designed to be relevant to studies in tropical areas;

(iii) believed the supply of standards and reference materials could not be considered without detailed investigation of how use could be made of regional banks of reference samples of purified compounds;

(iv) agreed to consider again, when more is known about the needs for these materials and the feasibility of preparing them, development of strategies to encourage the production of CRMs for filter aerosols and suspended particulate matter;

(v) recommended the development of seawater reference materials for determinations of carbon dioxide, based on principles stated by A. Dickson;

(vi) there was strong support for continuation of the very promising work reported at GESREM-II on seawater reference materials for nutrients, dissolved oxygen and pigments);

(vii) offered to develop and implement strategies for improving communication with scientists on the obtention and use of reference materials and standards and on QC practices in general. Early publication of relevant notes should be sought in such media as "Marine Chemistry:, "TRAC", and "Marine Pollution Bulletin";

(viii) offered to develop specific guidelines for the production, testing and storage of Working Reference Materials and encourage technical support to this activity where appropriate. Producer members will submit method descriptions to the Secretariat for distribution or possible publication in the UNEP Reference Methods series;

(ix) agreed to design a workplan and timetable of intersessional activities and appoint a core group including the secretariat (all sponsoring agencies) and the Chairman in order to oversee its implementation;

(x) offered to take intersessional action, to formulate a mechanism for quantitative evaluation of the implementation of its programme based on supply and demand statistics for CRMs and eventually on improved data quality (as evaluated by intercalibration studies).

71 A draft Workplan was submitted by the *ad hoc* group formed under Agenda Item 7. The Group discussed it, made amendments and agreed to adopt it as the Workplan for the next intersessional period (Annex IV). The *ad hoc* group also prepared, in tabulated form, needs for reference materials

expressed by participants during the session. These tables were discussed and modified by the Group and it was decided to attach them as an Annex to this Report (Annex V).

72 The Group then discussed a proposal by the ad-hoc group to extend the mandate of GESREM to include aspects of Quality Control.

73 In order to strengthen the application of reference materials in marine pollution monitoring programs and to encourage the use of these materials as part of wider Quality Control programmes, the mandate of GESREM should be extended to include the following additional item:

(xi) Provide advice on those aspects of Quality Control which require the preparation and use of certified and other reference materials.

Aspects which could be considered by GESREM as part of its new mandate include:

(a) The formulation of guidelines for the preparation and use of reference materials and their application to quality control charts;

(b) The design of programmes for encouraging the effective use of certified and other reference materials in regional and global monitoring projects;

(c) The provision of direct support, where possible, in the production of reference materials and in the determination of selected contaminants.

The Group also discussed and approved a proposal by Dr. A. Dickson to adopt the recommendation on carbon dioxide standards for oceanic measurements (Annex II).

9. OTHER BUSINESS

74 No other business was proposed for discussion.

10. ELECTION OF OFFICERS

75 The Chairman referred the meeting to the Technical Secretary, who invited nominations for Chairman for the coming intersessional period and the Third Session of GESREM. Dr. W.D. Jamieson was nominated as Chairman and was elected with acclamation. The Chairman took again the Chair and invited nominations for Vice-Chairman, Dr. J. Calder was nominated and elected with acclamation.

11. VENUE AND DATE OF THIRD SESSION

76 The Group considered that the Core Group, which will be formed, should hold at least two meetings, intersessionally, and decided that the Third Session of GESREM be held in the latter part of 1991 in Europe.

77 The Group expressed concern that a representative of the Community Bureau of Standards (BCR) was not able to participate and requested the IOC Secretariat to take steps to improve communications with and participation of BCR in the intersessional work and the next Session of the Group.

78 The representatives of some national agencies pointed out the need for official invitations to be sent at least two months before the next Session, since ample time is required for administrative clearances and relevant arrangements.

12. ADOPTION OF THE SUMMARY REPORT

79 The Draft Summary Report and Recommendations were adopted by the Group giving editorial licence to the Chairman and the Secretariat in order to formulate the final version.

13. CLOSURE

80 The Group and the Technical Secretary on behalf of the Co-sponsoring Agencies, thanked the Chairman for the positive and constructive manner he conducted the Session.

81 The Chairman closed the Session at 1600 hours on 25 January 1990.

ANNEX I

AGENDA

1. OPENING OF THE SESSION

2. ADMINISTRATIVE ARRANGEMENTS

   2.1 ADOPTION OF THE AGENDA
   2.2 DESIGNATION OF THE RAPPORTEUR

3. REPORT ON INTERSESSIONAL ACTIVITIES

4. REPORTS FROM USERS AND EXPERT GROUPS ON THEIR EXPERIENCE WITH THE USE OF REFERENCE MATERIALS AND ON THEIR NEEDS FOR REFERENCE MATERIALS

   4.1 OCEAN AND COASTAL AREAS PROGRAMME (UNEP)
   4.2 GEMSI (IOC)
   4.3 OPEN-OCEAN BASELINE STUDY
   4.4 ICES
   4.5 JGOFS
   4.6 WOCE
   4.7 NOAA
   4.8 JPOTS
   4.9 INTERNATIONAL MUSSEL WATCH

5. UPDATE BY PRODUCING AGENCIES AND LABORATORIES ON REFERENCE MATERIALS PREPARED SINCE THE FIRST SESSION OF GESREM AND ON MATERIALS PLANNED TO BE PREPARED IN BIENNIUM 1990/1991

   5.1 NRC/CANADA
   5.2 NIST/USA
   5.3 ILMR/IAEA
   5.4 EPA/USA
   5.5 NIES/JAPAN
   5.6 NSF/USA
   5.7 NOAA/USA
   5.8 REMCO/ISO
   5.9 IAPSO STANDARD SEAWATER SERVICE
   5.10 OTHERS

6. STATUS OF THE UPDATE OF THE CATALOGUE "STANDARD AND REFERENCE MATERIALS FOR USE IN MARINE SCIENCES" PREPARED BY THE US NOAA

7. DEVELOPMENT OF WORKPLAN AND IDENTIFICATION OF NEEDS FOR NEW SRM'S AND STANDARDS AND DESIGNATION OF TASKS ON BASIS OF ALL NEEDS IN RELATION TO REGIONAL SEAS RESEARCH AND MONITORING PROGRAMME; USE OF REFERENCE METHOD ZERO

8. RECOMMENDATIONS AND ACTION ITEMS

9. OTHER BUSINESS

10. ELECTION OF OFFICERS

11. VENUE AND DATE OF THIRD SESSION

12. ADOPTION OF THE SUMMARY REPORT

13. CLOSURE

ANNEX II

RECOMMENDATIONS

Recommendation GESREM-II.1

IMPLEMENTATION OF THE WORKPLAN OF THE GROUP OF EXPERTS ON STANDARDS AND REFERENCE MATERIALS

The Group of Experts on Standards and Reference Materials (GESREM),

Noting that the Workplan adopted by the Group includes all potential actions necessary to develop its role in assisting international, regional and national marine pollution monitoring and climate change programmes,

Considering that the implementation of the Workplan without constraints would require a substantial increase of available funds,

Recommends that the sponsoring agencies provide the support necessary for the implementation of the Workplan;

Decides to appoint a Core Group including the Secretariat (all sponsoring agencies) and the Group's Chairman in order to oversee the Workplan's implementation.

Recommendation GESREM-II.2

EXTENDING THE MANDATE OF THE GROUP OF EXPERTS ON STANDARDS AND REFERENCE MATERIALS TO INCLUDE ALL ASPECTS OF QUALITY CONTROL

The Group of Experts on Standards and Reference Materials (GESREM),

Noting the need to strengthen the application of reference materials in marine pollution monitoring programmes and to encourage the use of these materials as part of wider Quality Control Programmes,

Recommends that the mandate of the Group should be extended to include the following additional item:

> Provide advice on those aspects of Quality Control which require the preparation and use of certified and other reference materials;

Recommends that aspects which could be considered by the Group as part of its new mandate include:

(i) The formulation of guidelines for the preparation and use of reference materials and their application to quality control charts;

(ii) The design of programmes for encouraging the effective use of certified and other reference materials in regional and global monitoring projects;

(iii) The provision of direct support, where possible, in the production of reference materials and in the determination of selected contaminants.

Recommendation GESREM-II.3

DEVELOPMENT AND DOCUMENTATION OF REFERENCE METHODS AND REFERENCE MATERIALS FOR OCEANIC CARBON DIOXIDE MEASUREMENTS

The Group of Experts on Standards and Reference Materials (GESREM),

Noting the increasing needs by international and large-scale national geoscience and climate change related programmes for reference methods and reference materials for oceanic carbon dioxide measurements;

Encourages the development and documentation of appropriate reference methods and reference materials for oceanic carbon dioxide measurements;

Endorses the role of the Joint SCOR/UNESCO/ICES/IAPSO Panel on Oceanographic Tables and Standards (JPOTS) in co-ordinating and assessing towards preparing carbon dioxide standards for oceanic measurements;

Recommends that the Group clarify the international demand from the marine science community for certified reference materials for carbon dioxide measurements and identify an appropriate mechanism to prepare, certify and distribute such materials and pursue resources for this.

ANNEX III

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ANNEX IV

GESREM WORKPLAN

I. GUIDELINES FOR PREPARATION AND APPLICATION OF WORKING REFERENCE MATERIALS

A subgroup of GESREM will prepare a set of guidelines for the preparation of reference materials for intralaboratory use and their application in quality control procedures. The guidelines will give step-by-step indications (workbook approach) on how to collect and prepare the material, test it for homogeneity, and statistically evaluate the results in order to set up quality control charts. Producers of reference materials have agreed to provide descriptions of the methods used to prepare reference materials.

The new document will be based on existing guidelines that have been prepared by national or international agencies. The terms used will comply with the appropriate ISO recommendations as applied to the UNEP Reference Methods for Marine Pollution Studies series of which the new document will be part. The subgroup will consist of the Vice-Chairman of GESREM as chair of the subgroup, Dr. K. Okamoto, Dr. T. Gills, Dr. L. Mee, Dr. J. McLaren or Dr. S. Berman, and the Chairman of GESREM ex-officio. The subgroup will work by correspondence initially, but a meeting may be required to complete the document. The document will be available in complete draft form at the next GESREM meeting.

II. OVERVIEW OF PROGRESS TOWARD DEVELOPMENT OF REFERENCE MATERIALS AND DOCUMENTATION OF METHODS FOR THEIR PREPARATION

Individual members or small subgroups of GESREM will be designated for each of the highest priority categories of reference material needs and charged with remaining current on progress toward development of the needed reference materials and related reference methods. Each individual/subgroup will prepare a report to GESREM at its next Session giving details on progress and recommending action that GESREM should take. A special report to the Chairman of GESREM should be made as soon as important developments occur. Subgroups and members are:

(i) Inorganic nutrients and dissolved oxygen in seawater: Dr. L. Gordon
(ii) Pigments: Dr. C. Kennicutt and Dr. R. Bidigare
(iii) CO_2 system parameters in seawater: Dr. A. Dickson
(iv) Organic contaminants in marine matrices: Dr. L. Mee
(v) Trace elemental contaminants in marine matrices: Dr. J. McLaren or Dr. S. Berman
(vi) Biotoxins in marine matrices: Dr. W.D. Jamieson
(vii) Organometallic contaminants in marine matrices: Dr. J. McLaren or Dr. S. Berman
(viii) IAPSO Standard Seawater : Dr. P. Ridout.

III. PROVISION OF REFERENCE MATERIALS TO LABORATORIES IN DEVELOPING COUNTRIES

One of the mandates of GESREM is to facilitate the availability of reference materials to laboratories in developing countries that cannot obtain them through the normal channels. To make progress in this area, GESREM needs more information from the agencies that sponsor programmes in developing countries. GESREM asks that the joint Secretariat provide a revised report at its next Session containing the following information:

(i) description of needed reference materials, including for each,

(a) matrix
(b) analyte(s) to be measured and optimum concentration(s)
(c) basis for certification (2 or more independent methods, consensus value of "expert" laboratories consensus value of participating laboratories),
(d) likely demand/rate of usage.

(ii) names of points of contact within each programme who could serve as communication links to producers and redistributors of reference materials.

IV. COOPERATIVE EFFORTS TOWARD DEVELOPMENT OF NEW REFERENCE MATERIALS

A subgroup of GESREM is appointed to develop a process for collaborative production of reference materials, and if feasible, plan and oversee the production of a new reference material. The subgroup will work by correspondence and also meet as needed. A report from the subgroup will be presented at the next session of GESREM and the Chairman of GESREM will be kept informed on progress. The subgroup may consider the means of producing a tissue-based reference material collected from a tropical environment and certified for organochlorine pesticides. The subgroup will consist of Dr. L. Mee (Chairman), Dr. T. Gills, Dr. W.D. Jamieson. As needed other experts from GESREM, GEMSI or elsewhere may assist this subgroup.

V. PUBLICITY FOR AND DISTRIBUTION OF THE REVISED CATALOGUE OF REFERENCE MATERIALS

The availability of the revised catalogue "Standard and Reference Materials for Marine Science" will be announced in a variety of ways. A notice will be placed in various magazines and journals, including American Laboratory, Marine Pollution Bulletin, Marine Chemistry, Trends in Analytical Chemistry, International Marine Science Buletin ISO Bulletin (Action: Dr. A. Cantillo with others). Announcements also will be given to various ICES committees and working groups (Action: Dr. A. Cantillo, Dr. J.M. Bewers, Dr. P. Yeats and Dr. J. Calder). A presentation will be made at the BERM-4 Symposium by Dr. A. Cantillo, and an announcement will be placed on a Sciencenet bulletin board (Action: Dr. A. Cantillo and Dr. L. Gordon). A reference to and information on the catalogue and its contents will be included in the series of UNEP Reference Methods for Marine Pollution Studies dealing with Quality Assurance. The availability of the Catalogue will also be brought to the attention of the network of national institutions participating in UNEP's Regional Seas Programme (Action: UNEP and IAEA Secretariats). A notice will be placed in the next version of the catalogue of reference materials produced by the IAEA (Action: IAEA Secretariat).

The computerized version of the catalogue will be updated periodically by Dr. A. Cantillo (Action), upon receipt of new information from producing agencies. The producing agencies will send new and revised certificates of analysis for reference materials to Dr. A. Cantillo as they become available (Action: all members representing producing agencies).

The IOC Secretariat will provide for printing additional copies of the catalogue in its present form with the objective of having them available by mid-1990 (Action: IOC Secretariat).

ANNEX V

SOME NEEDS FOR REFERENCE MATERIALS EXPRESSED BY PARTICIPANTS

The following tables attempt to summarize the needs for reference materials expressed during the meeting. They identify the kinds of user community making such requests and provide a judgement as to the feasibility of preparing such a material. In several instances, the methods for producing and certifying specific reference materials have not been sufficiently well developed or proven to embark immediately on the preparation of such materials (i.e., there is a lack of feasibility). In some such cases, progress is being made in feasibility studies (e.g., nutrient/seawater RMs). In other instances, preparation of a needed material is feasible since the procedures are known and proven. In these cases, the likehood of a producing agency agreeing to prepare such a material depends upon the potential demand for it and the extent to which the particular analyte/matrix combination falls within the mandate and capability of the producing agency.

SEAWATER

Analyte	Matrix	Proponent[1] Group	Feasible[2]	Notes
Pigments (Individual)	Seawater	JGOFS (MS)	No?	Work in progress
Organics (OCs)	Seawater	GIPME (MS-P)	No	Anal.Diff (3)
CO_2 (High A/P)[6]	Seawater	WOCE/JGOFS (MS)	No	Work in progress
Nutrients (High A/P)	Seawater	JGOFS ICES (MS)	No	Sample integrity Prob.Work in Prog. (4)
Nutrients (Lower A/P)	Seawater	P	Yes?	(5)
Diss. Oxygen	Seawater	WOCE/JGOFS (MS)	No	Work in progress
Mercury	Riverine Water	ICES/ GIPME/ UNEP (P)	Yes	In preparation (NRCC)

NOTES:

1. MS denotes marine scientific community; P denotes pollution assessment and marine environmental protection community; without indication of size.

2. Feasible means that the techniques for preparing and certifying a reference material are established.

3. The analytical problems are those associated with certifying for a range of specific compounds unambiguously. Feasibility therefore depends on nature of analyte certification required. Shelf-stable sample may not be possible.

4. Needs relate to silicate, nitrate, nitrite, ammonia and phosphate. Major problem relates to sample/analyte integrity during long-term storage.

5. May be feasible and appropriate to provide RM for some nutrients at lower accuracy and precision specifications than those required by the physical oceanography community.

6. Accuracy/Precision.

SEDIMENTS

Analyte	Matrix	Proponent[1] Group	Feasible[2]	Notes
Trace Metals	Pelagic Sediment	Non-specific	Yes	(3)
Organics (OCs)	Pelagic	Non-specific	No	Anal.Diff.(4)
Trace Metals	Carbonate Sediments (Coastal/Tropical)	UNEP (OCA/PAC) (P)	Yes	
Organics (OCs)	Carbonate Sediments (Coastal/Tropical)	UNEP (OCA/PAC) (P)	(4)	
Organics (OCs)	Sediment (Organic-Rich)	UNEP (P)	$\sum$ Yes Ind.Cong.No?	(4)
Organics (PAHs)	Sediment (Organic-Rich)	UNEP (P)	Yes	

NOTES:

1. MS denotes marine scientific community; P denotes pollution assessment and marine environmental protection community; without indication of size.

2. Feasible means that the techniques for preparing and certifying a reference material are established.

3. There appears to be a substantial demand for such a material based on IAEA/MESL experience.

4. The analytical problems are those associated with certifying for a range of specific compounds unambiguously. Feasibility therefore depends on nature of analyte certification required.

BIOLOGICAL TISSUE

Analyte	Matrix	Proponent[1] Group	Feasible[2]	Notes
OCs	Bivalves (Tropical)	UNEP (P)	(3)	
PAHs	Bivalves (Tropical)	UNEP (P)	Yes	

NOTES:

1. MS denotes marine scientific community; P denotes pollution assessment and marine environmental protection community; without indication of size.

2. Feasible means that the techniques for preparing and certifying a reference material are established.

3. The analytical problems are those associated with certifying for a range of specific compounds unambiguously. Feasibility therefore depends on nature of analyte certification required.