Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials

First Session

Paris, 9-12 February 1987

Unesco

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IOC/GGE(SRM)-I/3
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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 Testonics 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
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
25. Third Session of the IOC Group of Experts on Effects of Pollutants
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

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1. OPENING OF THE SESSION

The interim Chairman of the Group of Experts on Standards and Reference Materials (GESRM), Dr Alan Walton, opened the meeting at 10.00 hours on 9 February 1987 welcoming the participants to the First Session of the Group, and explaining that he was acting as Chairman, having been Chairman of the GEMSI ad hoc Group on Reference Materials (see Document IOC/WC-GIPME-VI/3, para. 60).

Dr Mario Ruivo, Secretary of IOC, formally welcomed the participants to IOC, expressing his great appreciation to the Experts and their Organizations for their being willing to participate in this important activity. Dr Ruivo briefly recalled the development of the GIPME Programme and the associated Marine Pollution Monitoring System (MARPOLMON), and the present strong need to have an appropriate international mechanism through which relevant standards and reference materials could be supplied to the international programmes in continuous need of such materials. Dr Ruivo reiterated that IOC attached great importance to this as did the co-sponsors (IAEA and UNEP) of the Group, and ICES. The work of the group was greatly valued and would become a most significant part of the GIPME Programme.

Dr M. Gerges, representing UNEP-OCA/PAC stated that OCA/PAC attaches such great importance to data quality assurance in its Regional Seas Programme, now covering activities in ten regions, that reference methods are being developed for use in Regional Programmes, and there is therefore a clear need for standards and reference materials related inter alia to these reference methods.

The interim Chairman, also representing IAEA as a co-sponsor then declared the Session open. The List of Participants is given in Annex III.

2. ELECTION OF OFFICERS FOR THE SESSION

The interim Chairman suggested that a Chairman for the Session should be elected from one of the participating experts and requested nominations. Dr W.D. Jamieson was nominated, declared himself willing to serve as Chairman and was unanimously elected.

3. ADMINISTRATIVE ARRANGEMENTS

The elected Chairman took the Chair.

3.1 ADOPTION OF THE AGENDA

The Provisional Agenda (Document IOC/GGE(SRM)-I/1 prov.) was adopted as the Agenda for the Session (Annex I).

3.2 DESIGNATION OF RAPPORTEUR

Dr F. Culkin was designated as Rapporteur for the Session.

3.3 CONDUCT OF THE SESSION

It was agreed that the session would be conducted in Plenary. The Technical Secretary for the Session, Dr G. Kullenberg, introduced the

documentation provided for the Session which included certain documents not listed in the pre-circulated List of Documents, and pointed out relevant parts of some of the documents provided.

4. BACKGROUND INFORMATION AND REVIEW OF ON-GOING ACTIVITIES

The Secretariat introduced this item giving the following background.

The Thirteenth Session of the IOC Assembly (12-28 March 1985, Paris) considered the availability of standards and certified reference materials as an essential component in the conduct of intercalibration exercises and regional contaminant assessments (see Document IOC/WC-GIPME VI/7).

The Assembly instructed the Working Committee for GIPME, through its Group of Experts on Methods, Standards and Intercalibration (GEMSI), to prepare a proposal for an intergovernmental mechanism to co-ordinate the preparation and distribution of standard and reference materials for consideration by the Executive Council at its Nineteenth Session.

An ad hoc GEMSI Group was created to address this charge (Document IOC/GGE(MSI)-VI/3). Meetings of this ad hoc Group were convened in Geneva at UNEP-OCA/PAC, 3-4 June 1985, and in Washington DC at NOAA, (28-30 October 1985). The reports, workplan and proposals of the ad hoc Group werre discussed at the Seventh Session of GEMSI (Monaco, 13-20 November 1985), and a report was made at EC-XIX (IOC/GGE(MSI)-VII/3; IOC/WC-GIPME-VI/11 and IOC/EC-XIX/8, Annex I).

The Nineteenth Session of the IOC Executive Council (Paris, 6-12 March 1986) adopted Resolution XIX-2, Standard Reference Materials for Marine Pollution and Chemistry, in which it was decided to create a Group of Experts.

The Working Committee had noted "that the activity is not deemed as one in competition with producers' interests, but rather one of co-ordination to ensure that scientists in the various regions have materials available to them on a continuous basis" (IOC/WC-GIPME-VI/3, para 49). The Working Committee had also agreed that "the responsibility for "Standards" in GEMSI embodied a wider measure of responsibility, for standards in development of methods, quality assurance and proper use of standards and reference materials and that this remains valid" (IOC/WC-GIPME-VI/3 para. 58).

Following the suggestion of the Chairman, the Group then briefly considered the recommended Terms of Reference (Document IOC/WC-GIPME-VI/3, Annex VI), compared them with those of GEMSI (IOC Manual, Section 1.3.1, Revised Edition, December 1985), and concluded that the Terms of Reference as recommended by the Working Committee for GIPME were adequate and would not cause a conflict with GEMSI.

The Group also agreed that its name, as recommended by the Working Committee, was satisfactory.

During the present Session, the Group would review the Terms of Reference successively, starting with giving information from the producers on existing standards and reference materials, including availability, costs, characteristics and applicability for various types of equipment. Information was also given on plans for production of new materials during the coming two to four years.

The information provided is summarized in Annex IV and gives an up-dating on what was presented at the meeting of the GEMSI ad hoc Group on Reference Materials, (28-30 October 1985, Washington DC; Document IOC/GOSREM-II/3). Frequent reference was made to the report on "Standard and Reference Materials for Marine Science",prepared by NOAA, and it was recommended that this catalogue should be updated at regular intervals (1-2 years), through a suitable mechanism (Recommendation GESREM-I.2), and made available to potential users.

During the discussion it was emphasized that standards and reference materials form one part of a package required for quality control and assurance of environmental data; that the information concerning these materials was not widely spread to developing regions; that the use of such materials was usually not referred to in publications; that very little material was distributed to developing regions/laboratories; that the use of materials is often coupled to a stipulated method and possibly the aims/goals of the international/regional programme in question; that producers generally had to charge for distributing materials; that producers, however, would be willing to make materials available free of charge for training activities undertaken within the programmes of the sponsoring organizations; this offer was specifically made by NRC, Canada.

Several specific points were made in relation to experiences related by producers, including problems associated with the need for speciation, in particular in relation to organics, the need for separation of the individual chloro-biphenyl compounds, the difficulty with 'spiking' of samples, the requirement not to release any material for which concentration values are method-dependent. Some gaps were also identified to be further addressed under subsequent Agenda Items.

5. STATUS OF REFERENCE METHODS FOR MARINE POLLUTION STUDIES AND RELATED STANDARDS AND REFERENCE MATERIALS

A.paper prepared by Dr L. Mee, "Reference Materials and Methods in Marine Environmental Studies - Current Status and Requirements" was presented to the Group by Dr A. Walton. The importance of having a proven methodology available for the conduct of marine pollution studies, had been recognized several years ago in regional seas programmes of both UNEP and IOC. This led to the establishment of a specific project by UNEP in 1983/1984 designed to produce reference methods for the determination of chemical, physical and biological parameters in a variety of environmental materials (sampling and data management techniques were also included). The project is supported by UNEP and is being pursued in the International Laboratory of Marine Radioactivity in Monaco in co-operation with other international organizations, viz.., IOC, FAO, WHO and WMO.

It is generally intended that the reference methods produced in this project would be used in laboratories participating in regional programmes, would serve as aids in the resolution of legal disputes arising from trans-boundary pollution and as a basis for the training of technical staff - largely from laboratories in developing countries. Methods are continually updated, improved and reviewed in co-operation with consultants and expert bodies to ensure their relevance and reliability in the solution of current pollution problems.

The author pointed out that to improve data quality:

(i) reference methodology needs to be linked with adequate training of personnel in analytical and sampling techniques;

(ii) reference methodology has to be combined with the use of reference materials - a practice not yet accepted by the scientific community as a whole;

(iii) reference materials needed in the application of reference methodology are not widely available and, in the case of developing countries, the price can be a deterrent factor in their use;

(iv) mechanisms for the distribution of existing materials need to be improved;

(v) some new reference methodology (eg., organotins and organophosphorus for marine materials needs to be developed as a matter of priority.

From the development programme of reference methods has come a clear indication of needed reference materials in all categories, whether they be certified reference materials, research materials or intercomparison materials. A complete listing of the current status of reference methods was presented to the Group. A total of 38 methods has been published, 25 are in preparation and a further 10 at an advanced planning stage. Recommendations for reference materials based on existing and planned methodology were presented for use in the development of priority needs by the Group.

The representative of the Oceans and Coastal Areas Programme Activity Centre (OCA/PAC) of the United Nations Environment Programme (UNEP) presented an overview of UNEP's Regional Seas Programme which, at present covers ten regions of the world. For each of these regions an action plan is formally adopted by the governments of the respective region. One of the basic components of these action plans is the monitoring and research component which is carried out by networks of national institutions and co-ordination on UNEP's behalf by a number of UN and non-UN organizations.

With a view to achieving the necessary reliability of analytical results obtained through the various monitoring and research components of the programme, so that regional and global comparability of the data becomes possible, UNEP, in co-operation with the International Laboratory of Marine Radioactivity (ILMR) of the IAEA and a number of specialized Agencies developed a series of "Reference Methods for Marine Pollution Studies". A list of these methods is contained in the Catalogue of Reference Methods which was provided to the Group by the UNEP representative, and is given in Annex V.

The UNEP representative further stressed the importance of quality control of the data collected and indicated that good quality data can only be obtained if sufficient time and effort is devoted to quality assurance. The quality of the data generated by the UNEP Regional Seas networks is, so far, controlled through mandatory intercomparison exercises, which obviously require appropriate standards and reference materials. Thus, the interest of UNEP-OCA/PAC in making these materials available to the marine scientific community of the Regional Seas Programme is evident, and hence, its decision to co-sponsor the present Group.. UNEP expects that the Group's collaborative efforts will lead to the improvement of the situation regarding quality control of the data by providing the reference materials needed for the various reference methods which are now being used as mandatory by the laboratories participating in the UNEP programme.

Explaining the philosophy behind the development of UNEP's Reference Methods, and the principles used in their preparation, the UNEP representative indicated that these Reference Methods are devised to meet criteria which include:

(i) analytical methods which must be applicable on a worldwide basis, including many developing countries, and should make use of readily available and serviceable equipment, reagents, etc;

(ii) these analytical methods must be reliable and capable of producing data which are both reasonably accurate, precise and reproducible. "Reasonably" means of sufficient accuracy and precision to allow meaningful interpretation for the objectives of regional marine pollution studies. They should be adequate for intra-regional and inter-regional comparisons for the Global Environment Monitoring System (GEMS) of UNEP.

(iii) the methods must be used in conjunction with appropriate mandatory quality control which is attained through reference materials (standards) available on an international basis;

(iv) these Reference Methods are not to be taken to be "once only" or "best" methods. Rather, as analytical techniques and instrumentation improve and become more generally available, the Reference Methods are revised and re-tested (meeting the constraints of (a) above). Also, they must change and/or increase in scope to satisfy the temporal changes in requirements for regional and global marine pollution projects.

It was further pointed out that UNEP Reference Methods, after being issued as a draft, are tested, through research contracts, by the co-operating agency and by ILMR. Comments on the methods are received after their application in the monitoring programme, as well as in intercalibration exercises and training courses. Methods are revised, if required, and produced in the form of a first edition of the reference methods.

6. IDENTIFICATION OF NEEDS FOR STANDARDS AND REFERENCE MATERIALS AND ASSOCIATED PRIORITIES

Under this Agenda Item, background papers concerned with inorganic material and organic-type pollutants were considered.

INORGANICS

Dr P.A. Yeats introduced his background paper, stating that consideration of requirements for reference materials in the inorganic marine chemistry field has generated the following list of high priority reference materials:

(i) estuarine seawater reference material in salinity range 5-10 for trace metals; it remains to be decided what metal levels and other estuarine characteristics would be most appropriate;

(ii) coastal sediment from a tropical environment for trace metals;

(iii) pelagic clay sediment for trace metals;

(iv) estuarine or coastal seawater sample for mercury.

Other possible reference material developments include expansion of the number of elements for which NASS-2/CASS-1/SLRS-1 (see Annex IV) are certified, reducing the uncertainty of the certified values for NASS-2 etc., investigation of potential for species specific metal reference materials, development of reference material for metals in suspended matter, expanding the types of sediment reference materials (different size fractions, carbonate sediments, organic rich sediments, etc.,) non-detrital metal content of sediments, nutrient and alkalinity reference materials and a low level seawater reference material for radionuclides. These are all lower priority for one or more of several reasons. The analytical or geochemical procedures may not yet be adequately established, the "market" may be small or the feasibility of development of the reference material may not be established. Some or all of these may become important in the future, but they are not seen as high priority at this time.

The need for reference materials for nutrients in seawater would appear to be an open question. While there have been problems intercomparing data from different laboratories in several experiments, the value of reference materials in helping to address this problem is uncertain. Workers in this field appear to think that adequate standardization procedures are available and observed differences could result from sampling heterogeneity and storage procedures (ICES Marine Chemistry Working Group deliberations). The difficulty of preparing reference materials for nutrients was also discussed, the biggest potential problem being one of sample stability.

There was also a discussion of the advantages and disadvantages of a sediment reference material for non-detrital (available) metals. Although this type of reference material will be of great potential value in marine geochemistry and biological effects work, several advances have to be made before development of a reference material could be considered. The preferred analytical methods for non-detrital analysis have to be agreed upon and established. This will probably be a problem because different methods will be preferred for different applications. There is also understandable reluctance on the part of the developers of reference materials to develop reference materials for which the analytical values are so method dependent.

ORGANICS

Dr Topping presented Dr Farrington's background note on Standards and Reference Materials Requirements for Organic Pollutants in Marine Samples. In his introduction, the author referred to the need for and role of standards and reference materials in analytical quality assurance work. He then identified groups of organic compounds which required pure standards to assist in the identification and quantification of these compounds in environmental samples i.e., chlorobiphenyls, polyaromatic hydrocarbons; and the chlorinated hydrocarbons (toxaphene, camphenes). He did not assign a priority list for these compounds since he viewed this as one of the first tasks of GESREM He then referred to the measurements of organic compounds being made in the three marine compartments - water, sediments/particulate and biological tissue, identified the need for standards and reference materials for this work, suggested approaches by which the group could proceed regarding the preparation of these reference materials, outlined the advantages and disadvantages of the various options and the problems that might be encountered in producing, maintaining and transporting representative and relevant reference materials. He drew the Group's attention to the longer term need for reference materials for studies connected with the air/sea inteface, metabolites and reaction products. In conclusion, he identified the potential producers of reference materials and expressed a hope that GESREM should work constructively with these organizations in order to avoid duplication of effort and to meet the clear demand by the marine science community for appropriate standards and reference materials for organic compounds. Following the Group's discussion of Dr Farrington's paper, the following summary of the suggestions for standards and reference materials given therein was prepared:

Standards

(1) Chlorobiphenyls - a minimum number of congeners

(2) Polycyclic aromatic hydrocarbons (PAH) - minimum list should include those requested for the recent IOC/ICES intercomparison exercise for hydrocarbons in tissue (3/HC/BT).

Reference materials

(1) Seawater - for the measurements of dissolved/dispersed petroleum in seawater using the UV/fluorescence procedure which is currently calibrated using chrysene as a standard:

Proposal : to prepare an aqueous sample containing a mixture of selected PAHs using HPLC column generator, or

to collect a contaminated harbour sample which is subsequently diluted to prepare a reference material.

Sediments

Samples are required which include a range of selected PAHs and individual CBs.

Comment: both of these samples are currently in preparation by the National Research Council, Canada.

Biological tissue

Samples of fish oil, fish and shellfish tissue are required for both individual CBs and selected PAHs. Natural materials are preferable, though there is no guarantee that they would contain the range and concentration of analytes required. As an interim measure, spiked samples could be made specifically to order with respect to composition and would be much cheaper (by an order of magnitude) to prepare and certify, but they have the disadvantage that the analytes would not be incorporated naturally into the matrix.

Another option that might be considered is to expose cultivated organisms to seawater 'spiked' with a range of individual organic compounds. This would provide a matrix with naturally incorporated analytes with the proviso that the internal distribution of the individual analytes may not be the same as organisms exposed to contaminated seawater in the real environment.

Ideally, the reference materials should be distributed as wet tissue, but the producers' attention is drawn to the problems of homogeneity and transport associated with this form of material. Freeze dried tissue is easier to homogenize and transport, but changes in matrix following freezing will influence the extraction of organic compounds and will lead to losses of the more volatile compounds.

The existence of intercomparison materials, for which the levels of contamination are generally not known except by the producer, and which can be used for quality control purposes, was considered in relation to the US-EPA programme and also existed within the Japan-EPA/NIES programme, but such materials were generally not produced by NRC or NBS. These organizations could give advice on competent contractors who, for a reasonable price, could produce materials. The International Laboratory of Marine Research (ILMR) of the International Atomic Energy Agency (IAEA) produces intercomparison samples. Within the US-EPA programme for quality control of drinking water and control of municipal and industrial discharges, intercomparison materials are also produced.

Intercomparison certified materials equivalent to "performance evaluation samples" are prepared by US-EPA as sample concentrates in sealed ampoules for dilution to volume in the laboratory and subsequent analyses as unknown 'challenge' samples. Such samples would be available to IOC and UNEP for the following sample series: minerals, nutrients, trace metals, phenol, cyanide, oil/grease, residues (solids), chlorinated hydrocarbon pesticides, herbicides, volatile organics, aroclors (see Annex IV).

In Japan, a similar programme to the US-EPA one exists and it is possible that selected intercalibration samples can be obtained through NIES, acting also as the Japan Focal Point for INFOTERRA.

7. IDENTIFICATION OF PRODUCERS AND REQUIREMENTS FOR NEEDS NOT COVERED

On the basis of the three background papers discussed above, the information provided by the Secretariat on on-going monitoring programmes in various regions, the existing reference methods, and information provided by the producers of reference materials, as well as that contained in the catalogue prepared by NOAA, Table 1 was prepared in an attempt to illustrate the connection between monitoring needs, reference methods, reference materials and standards. The Table also facilitates identification of gaps in available reference materials. The Table, together with the deliberations of the Group, were used to identify the present needs and potential producers of new reference materials and to give an indication of the timeframe for development, where appropriate. The Group understood that several other needs would emerge from further production of reference methods, and that these needs would be considered after consultation with GEMSI at a later appropriate time. The presently identified needs are summarized as follows:

(i) estuarine water for trace metals; potential producer NRC, of one batch in one to two years' time; starting time 1987;

(ii) coastal sediments from selected tropical area for trace metals and selected organics; NBS may be willing to do this in a years' time (1988);

(iii) pelagic clay sediment for trace metals; NRC may be interested in this in a years' time (1988) provided co-operation with oceanographic institutions is possible; NRC may also co-operate with NBS on this matter;

(iv) mercury in sea water; NRC possible producer for coastal seawater or estuarine water; the IOS Standard Seawater samples will be investigated for the content and variability, possibly by Bedford Institute and Marine Laboratory, Aberdeen;

(v) methylmercury in fish tissue is being investigated by NIES and material may be available in 1989;

(vi) organotins; NIES is working on this problem and reference materials for fish tissue and possibly bay sediments could be ready in 1988;

(vii) organochlorines and PAH: (i) NRC has sediment materials for PAH or PCB determinations and intends to extend the certification; NRC is producing a Northern Shark liver oil material and a lobster hepatopancreas material is possible and may be produced in 1988; (ii) NBS is preparing a marine sediment material; and (iii) US-EPA is preparing an estuarine sediment material;

(viii) dissolved/dispersed hydrocarbons in seawater are a high priority, but producers cannot as yet state how this may be accomplished; provided appropriate collaboration can be arranged with e.g., Woods Hole Oceanographic Institution and Bedford Institute of Oceanography, NRC will allocate laboratory and personnel resources to a feasibility study;

(ix) nutrients (mainly nitrate, nitrite, silicate, phosphate) will be discussed at the forthcoming ICES Marine Chemistry Working Group for further consideration by the ICES Hydrography Committee and ICES Advisory Committee on Marine Pollution; the Group together with GEMSI, will be informed of developments;

(x) alkalinity and CO_2 in seawater are being investigated by different researchers in France, UK and Canada; there is no need for further action until the results are known; the Group will be kept informed through its contact with IOS in the UK.

The Group also considered the need for intercalibration and intercomparison materials on the basis of information provided by UNEP, IAEA and IOC. For the period 1987, it is estimated with reasonable certainty, that there will be a need for:

(i) 150 samples of petroleum hydrocarbons in sediments and biota;

(ii) 50 samples for trace metals (especially Hg, Cd, Cu, Pb) in sediments.

Further needs are envisaged for 1988, including possibly samples for selected organochlorines in mussel and oyster tissue.

The Group was informed that

(i) US-EPA can supply intercomparison material from available stocks;

(ii) NBS and NRC can give advice on potential contractors who produce materials at a reasonable price; contractors who have worked with NRC need about three months advance notice to supply sediment reference materials for either trace metals or trace organics determinations.

It was agreed that co-ordinators of training workshops and intercomparison exercises should contact the relevant members of the Group, giving specifications of needs and requesting the most appropriate procedure to obtain required materials.

8. DESIGN OF A POSSIBLE DISTRIBUTION MECHANISM AND ASSOCIATED REQUIREMENTS

The Group considered various possibilities of generating a network for distribution of certified reference materials and possibly associated working reference materials. It was agreed that the Secretariat should explore the possibility of using, as secondary distributing centres, selected regional analytical centres, i.e., marine laboratories involved in on-going programmes, which have, or can acquire the ability to produce relevant working reference materials. It was recognized that problems were associated with the transport of materials and the producers were willing to give information on their experience in this matter to the secondary distribution centres, once these had been identified. The regional analytical centres may be identified through appropriate consultations between the co-sponsors and with GEMSI, and possibly others, should this mechanism be the chosen one.

The producers agreed to consider how their certified reference materials could best be made available to the international regional programmes presently on-going or planned for future implementation. It was agreed that the materials should be made available through the co-sponsors of the Group (IAEA, UNEP, IOC). NRC would investigate the possibility of its certified reference materials being made available free of charge, but it would probably

be necessary for NBS and US-EPA to charge for their materials. The NIES may be willing to supply materials free of charge.

The need for working reference materials is evident. The Group considered that guidelines on how to prepare such materials should be available in the form of "Reference Methods" within the UNEP Regional Seas Programme.

It was agreed that the Group would prepare such draft guidelines with the responsibilities distributed as follows:

(i) for sediments, NRC and NBS;
(ii) for biota, Dr Topping in co-operation with relevant groups and scientists;
(iii) for seawater, NRC in co-operation with Bedford Institute of Oceanography.

9. RELATIONSHIPS WITH OTHER BODIES

The Group concluded that the catalogue of available reference materials was very useful and recorded its gratitude to Drs. J. Calder and A. Cantillo for their efforts and thanked NOAA for having supported it. It was further agreed and recommended that the catalogue should be up-dated at intervals. The Group expressed its willingness to assist in the updating. It was agreed that a suitable mechanism for updating and distribution might be established through consultations between the co-sponsors and NOAA, with IOC taking the lead in this activity (Recommendation GESREM I-2).

The Group agreed that a close relationship with GEMSI was necessary and that the Chairman, or his designate, should participate in GEMSI sessions. A number of specific items were identified for which the Group requests advice from GEMSI (Recommendation GESREM I-5). The GEMSI representative will bring this to the attention of GEMSI.

The relationship and interaction with ICES was secured through participation on an ex officio basis of the Chairman of the ICES Marine Chemistry Working Group (MCWG) in sessions of the Group. Several specific items of concern to both this Group and ICES/MCWG had been identified, e.g., nutrients, dissolved/dispersed petroleum hydrocarbons, the need for regional contacts and the updating of the catalogue. These would be brought to the attention of the MCWG through its chairman.

The Group was informed that contact had been established formally with the REMCO of ISO, who had expressed interest in being informed of the work of the Group. A copy of the report of the Session will be sent to REMCO. It was agreed that, for the time being, the substantive contact with REMCO would be maintained through the NBS representative at the Group.

It was also agreed that continued contact with BCR and the involvement of BCR in the work of the Group is very desirable.

The Group also discussed the need for identifying other organizations or laboratories involved in producing relevant materials. It was agreed that members of the Group would send information concerning this matter to the Secretariat.

10. ELECTION OF OFFICERS

Pursuant to the IOC Guidelines for the Structure and Responsibilities of IOC Subsidiary Bodies (IOC Manual, Part I, Section 5), the Group was requested to elect a Chairman to serve for the intersessional period and the subsequent session. The Group elected Dr W.D. Jamieson unanimously.

11. OTHER MATTERS

The Group agreed that a Second Session should be convened at an appropriate time and place in about a year from now (Recommendation GESREM I-6) and briefly considered agenda items and background material to be solicited for that session.

The following items were considered important:

(i) review of intersessional activities;

(ii) review of on-going activities affecting the availability of reference materials;

(iii) identification of needs for reference materials and standards;

(iv) distribution mechanisms;

(v) relationships with other bodies.

The following background information should be solicited in the form of appropriate notes:

(i) surveys of the usage of reference materials;

(ii) needs for reference materials in marine organic chemistry (non-pollution) aspects;

(iii) GEMSI views concerning needs for reference materials.

Selection of possible contributors would be made in consultation between the co-sponsors, the Chairman, and the GEMSI and ICES representatives.

12. ADOPTION OF THE SUMMARY REPORT

The Group adopted the Summary Report of the Session.

13. CLOSURE

The Members of the Group and the Secretariat thanked the Chairman for his constructive and positive conduct of the Session.

The Chairman closed the Session at 13.00 hours on 12 February 1987.

TABLE 1.1 : REFERENCE MATERIALS RELEVANT TO SUBSTANCES PRESENTLY BEING MONITORED IN SOME REGIONAL SEAS AND MARPOLMON PROGRAMMES

INORGANICS

Substance	Component	Reference * Method Number	Area	Materials and Comments
(A) Hg	Fish tissue	Nº 8: total/ cold vapour	Coastal to open sea; estuaries	EPA QC: (see NOAA Catalogue for reference to existing materials);
(B) Zn	"	Nº 11		" "
(A) Cu	"	Nº 11		" "
(A) Pb	"	Nº 11		TORT-1; EPA QC
(A) Cd	"	Nº 11		DOLT-1
(C) Mn	"			DORM-1
(C) Se	"	Nº 10		EPA QC
(C) As	"	Nº 9		EPA QC
(B) Hg methyl	"	Nº 13		Does not exist at present, but NIES looking into it
(A) Hg	Mytilus Molluscs Bivalves	Nº 8		Mussel CRM Nº 6, NIES, non ceritified (see NOAA catalogue)
(A) Cd		Nº 11		"
(C) Ni				"
(A) Cu		Nº 11		"
(C) Zn		Nº 11		"
(A) Pb		Nº 11		"
(B) Co				Not certified
(C) Fe				
(B) Cu	Sea water	--	Coastal; Estuarine	Priority A for estuarine seawater to be developed. NRC may prepare one
(B) Cd	"			NRC: CASS 1 Coastal sea water
(B) Pb	"	--		
(C) Zn		--		
(A) Hg		Nº 19		
(C) Cr		--		
(C) Fe		--		
(A) Hg total	Marine sediments	26, total	Coastal; Estuarine Near shore	Exists for temperate areas — MESS 1, BCSS 1, all trace metals (coastal marine, estuarine, harbour sediments)
(A) Cd		27		May be developed for tropical areas (Priorities A-B)
(A) Cu		33		
(A) Pb		34		
(B) CO		32		NRC = harbour sediment material under development for trace metals
(C) Mn		38		
Zn		39		

A = top priority
B = secondary priority
C = not considered prirority
* = according to present list (see Annex V)

TABLE 1.2: REFERENCE MATERIALS RELEVANT TO SUBSTANCES PRESENTLY BEING MONITORED IN SOME REGIONAL SEAS AND MARPOLMON PROGRAMMES

ORGANICS

Substance and Reference material Priority	Component	Reference * Method Number	Area	Materials and Comments
(A) DDTs (B) PCBs (C) PCCs	Marine Sediments " "	17 total	Coastal estuarine	NBS = PCB's, PAH's Pesticides from Baltimore harbour sediments NRC = CS-1, HS-1, HS-2 total chlorinated biphenyls as Arochlor 1254 coastal and harbour sediments; individual compounds for HS-1 and 2
(A) PCBs	Shrimp muscle	14 packed column	Coastal	NRC = Standard solutions for individual chlorinated biphenyls; NRC = Being developed using Northern Shark liver oil with PAH's and possibly other compounds (NSLO-1)
(A) DDTs	"	40 capillary column	"	NBS = PCBs in human serum
(B) BHC	"	---	"	Reference materials do not exist for marine tissue and sediments
(A) PCBs (A) DDTs	Mytilus; Mullus and Molluscs "	14 packed column 40 capillary column	Coastal	NRC = may prepare 6-7 toxaphene congeners; may proceed using lobster hepatopancreas NBS = is preparing material as mixture of pesticides EPA = toxaphene, DDE, DDT in natural fish tissue NBS, EPA = have several materials available for intercomparison purposes, e.g. in hexane.
(A) Petroleum Hydrocarbons Diss. disp. total	Sea water	IOC/UNEP Manuals & Guides (No. 11, 13, ..)		Chrysene usually used as standard; reference materials do not exist; high priority to develop a natural material for reference material
(A) "	Sediments			NRC = 4 harbour sediment types for 16 compounds of PAHs (HS3-6) and estuarine for PAHs (SES-1)
(A) "	Mytilus; Mullus edilus barbatus			

ANNEX I

AGENDA

1. OPENING

2. ELECTION OF OFFICERS FOR THE SESSION

3. ADMINISTRATIVE ARRANGEMENTS

   3.1 ADOPTION OF THE AGENDA
   3.2 DESIGNATION OF RAPPORTEUR
   3.3 CONDUCT OF THE SESSION

4. BACKGROUND INFORMATION AND REVIEW OF ON-GOING ACTIVITIES

5. STATUS OF REFERENCE METHODS FOR MARINE POLLUTION STUDIES AND RELATED STANDARDS AND REFERENCE MATERIALS

6. IDENTIFICATION OF NEEDS FOR STANDARDS AND REFERENCE MATERIALS AND ASSOCIATED PRIORITIES

7. IDENTIFICATION OF PRODUCERS AND REQUIREMENTS FOR NEEDS NOT COVERED

8. DESIGN OF POSSIBLE DISTRIBUTION MECHANISM AND ASSOCIATED REQUIREMENTS

9. RELATIONSHIPS WITH OTHER BODIES

10. ELECTION OF OFFICERS

11. OTHER MATTERS

12. ADOPTION OF SUMMARY REPORT

13. CLOSURE

ANNEX II

RECOMMENDATIONS

Recommendation number	Title
GESREM-I.1	Development and preparation of reference materials
GESREM-I.2	Information on available standards and reference materials
GESREM-I.3	Mechanism for provision of reference materials
GESREM-I.4	Provision of manuals for methods of preparation of reference materials
GESREM-I.5	Co-operation with other Groups of Experts
GESREM-I.6	Second Session of GESREM

Recommendation GESREM-I.1

DEVELOPMENT AND PREPARATION OF REFERENCE MATERIALS

The GIPME Group of Experts on Standards and Reference Materials,

Noting the identified priority needs for development of reference materials for the IOC MARPOLMON and the UNEP Regional Seas Programme,

Being aware of existing Reference Methods for Marine Pollution Studies,

Recommends that producing agencies be encouraged to undertake the development and preparation of reference materials to satisfy these needs,

Recommends further that the co-sponsors of the Group of Experts supply information to producing agencies indicating from which regions natural materials for use in preparations might be collected.

Recommendation GESREM-I.2

INFORMATION ON AVAILABLE STANDARDS AND REFERENCE MATERIALS

The GIPME Group of Experts on Standards and Reference Materials,

Noting the need to circulate up-to-date information concerning available standards and reference materials for use in marine pollution monitoring and marine chemistry studies,

Noting also the need to provide this information at regular intervals, in particular to developing laboratories and regional programmes,

Recommends that IOC explores ways in which the catalogue "Standard and Reference Materials for Use in Marine Science", produced by NOAA, could be regularly updated.

Recommendation GESREM-I.3

MECHANISM FOR PROVISION OF REFERENCE MATERIALS

The GIPME Group of Experts on Standards and Reference Materials,

Recognizing that mechanisms must be established which can ensure the provision of standards and reference materials, in particular to developing countries, at minimal cost,

Recommends that producers of reference materials explore such mechanisms,

Recommends further that an operational mechanism for distribution of materials be formulated through consultation among the co-sponsors, possibly making use of selected Regional Analytical Centres, which would receive certified reference materials and possibly produce working reference materials for regional distribution to laboratories.

Recommendation GESREM-I.4

PROVISION OF MANUALS FOR METHODS OF PREPARATION OF OF REFERENCE MATERIALS

The GIPME Group of Experts on Standards and Reference Materials,

Recognizing that analysts need to use routinely and frequently reference materials which closely resemble the samples being analyzed,

Noting that information on the preparation of materials for use as certified reference materials may aid analysts in their own preparation of intra-laboratory working references,

Recommends that producers of reference materials prepare descriptions of their preparation methods in a suitable format, e.g., adopted by ISO and by UNEP in its series "Reference Methods for Marine Pollution Studies".

Recommends further that the co-sponsors consider the most appropriate way of publishing the descriptions.

Recommendation GESREM-I.5

CO-OPERATION WITH OTHER GROUPS OF EXPERTS

The GIPME Group of Experts on Standards and Reference Materials,

Recognizing the need for co-ordination of activities and advice,

Urges the Secretariat to ensure continuing co-operation and collaboration between the other Groups of Experts in the GIPME Programme and GESREM,

Requests the assistance of GEMSI in

(i) identification of current and future requirements for reference materials in all aspects of marine analytical methods;

(ii) identification of new reference materials for inter-comparison exercises.

Recommendation GESREM-I.6

SECOND SESSION OF GESREM

The GIPME Group of Experts on Standards and Reference Materials

Recommends that the Second Session of GESREM be held in the first half of 1988, the date and venue to be decided in consultation between the co-sponsors and the Chairman of the Group of Experts.

ANNEX III

LIST OF PARTICIPANTS

MEMBERS OF THE GUIDING GROUP

Dr F. Culkin
Institute of Oceanographic Sciences
Wormley
Godlaming
Surrey GU8 5UB
UNITED KINGDOM

Tel: Wormley 042 879-4141
Telex: 858833

Dr D. Jamieson (Chairman)
Marine Analytical Chemistry Standards
Atlantic Research Laboratory
National Research Council
1411 Oxford Street
Halifax, N.S,
CANADA

Tel: (902) 426-8279
(902) 426-8332

Dr K. Okamoto
National Institute for Environmental Studies
Yatabe-machi, Tsukuba
Ibaraki 305
JAPAN

Tel: 0298 51-6111
Cable: KOGAIKENTSUKUBA

Dr P. Reed
US National Bureau of Standards
Office of Standards Reference Materials
B 311 Chemistry Building
Gaithersburg
MD 20899
USA

Tel: (301) 975-2013

Dr G. Topping
DAFS, Marine Laboratory
P O Box 101
Victoria Road
Aberdeen
UNITED KINGDOM

Tel: 0224-876544 (also representing ICES)

Dr J. Winter
Environmental Monitoring & Support Laboratory
Cincinatti
USEPA
Cincinatti
OH 45268
USA

Tel: (513) 569-7325

Dr P. Yeats
Department of Fisheries and Oceans
Bedford Institute of Oceanography
P O Box 1006
Dartmouth
Nova Scotia B2Y 4A2
CANADA

Tel: (902) 426-7272

SECRETARIAT

Dr G. Kullenberg
Technical Secretary
Marine Pollution Research and
Monitoring Unit (MPU)
Intergovernmental Oceanographic Commission
Unesco
7 Place de Fontenoy
75700 Paris

Tel: 45.68.39.92
Telex: 204461F

Mr S.K. Jensen
IOC Associate Expert
Marine Pollution Research and
Monitoring Unit (MPU)
Intergovernmental Oceanographic Commission
Unesco
7 Place de Fontenoy
75700 Paris

Tel: 45.68.40.16
Telex: 204461F

Dr A. Walton
International Laboratory of Marine
Radioactivity
IAEA
Musee Oceanographique
MC-98000

Tel: 93.50.44.88
Telex: 479378 ILMR
Telemail: (OMNET)IAEA.MONACO

Dr M. Gerges
Oceans and Coastal Areas Programme
Activity Centre (OCA/PAC)
United Nations Environment Programme
P O Box 30552
Nairobi
KENYA

Tel: 333930
Telex: 25164 UNEPRS KE

ANNEX IV

INFORMATION FROM PRODUCERS

NATIONAL RESEARCH COUNCIL, CANADA

1. The document "Reference materials available from the Marine Analytical Chemistry Standards Program of the National Research Council of Canada" is attached.

2. Work in progress:

- a harbour marine sediment reference material with reliable values for trace elements, minor and matrix inorganic constituents;
- a marine fish liver oil (northern shark (dogfish)) with reliable values for a range of xenobiotic organic constituents such as organochlorines, other pesticides, PAH;
- determine reliable values for xenobiotic organic analytes not now certified in the CS-1, HS-1, HS-2, HS-3, HS-4, HS-5, HS-6 and, possibly, SES-1 marine or estuarine sediment reference materials;
- a lipid-containing lobster tomalley (lobster digestive gland) homogenate for trace metals and for trace xenobiotic organics;
- synthetic, pure organic compounds:

(i) ^{13}C-labelled hexachlorobiphenyl (IUPAC No. 153)
(ii) 6 to 10 selected toxaphene congeners
(iii) selected chlorbiphenyl metabolite compounds
(iv) selected nitro-PAH compounds.

Environmental Reference Materials

(A) Two coastal marine sediments (MESS-1 and BCSS-1), with reliable values for 13 trace elements (Be, V, Cr, Mn, Co, Ni, Cu, Zn, As, Sb, Cd, Hg an Pb) and for 12 minor and matrix constituents (C, Na_2O, MgO, Al_2O_3, SiO_2 P_2O_5, S, Cl, K_2O, CaO, TiO_2 and Fe_2O_3).

(B) One coastal marine sediment (CS-1) and two harbour marine sediments (HS-1 and HS-2), with reliable values for total chlorinated biphenyl content (expressed as Arochlor 1254) and, in the cases of HS-1 and HS-2 for 10 individual chlorinated biphenyl congeners.

(C) Four harbour marine sediments (HS-3, HS-4, HS-5 and HS-6) with reliable values for 16 polycyclic aromatic hydrocarbons. The hydrocarbons are naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz (a)anthracene, chrysene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, dibenz (a,h)anthracene and indeno(123-cd)pyrene.

(D) One estuarine sediment (SES-1) spiked with known amounts of 16 polycyclic aromatic hydrocarbons. The hydrocarbons are the same 16 listed for the HS-3, -4, -5 and -6 series.

(E) One coastal seawater (CASS-1) with reliable values for 10 trace elements. The elements covered are Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd and Pb.

(F) One open ocean seawater (NASS-2) with reliable values for 13 trace elements. The elements covered are the same as those for CASS-1, with the addition of Mo, U and Se(IV). This material replaces the earlier NASS-1.

(G) One river water (SLRS-1) with reliable value for 10 trace elements. The elements are the same as those for CASS-1.

Suggested uses for the above materials include calibration of instruments and controlling analytical methods.

Calibration Standards

(A) A set of four mixtures of pure, synthetic chlorinated biphenyls in iso-octane (CLB-1), covering 51 individual chlorinated biphenyl congeners. The congeners covered are IUPAC #15, 18, 31, 40, 44, 49, 52, 54, 60, 77, 86, 87, 101, 103, 105, 114, 118, 121, 128, 129, 137, 138, 141, 143, 151, 153, 154, 156, 159, 170, 171, 173, 180, 182, 183, 185, 187, 189, 191, 194, 195, 196, 200, 201, 202, 203, 205, 206, 207, 208 and 209. Each mixture in the set contains 15 or 16 congeners, including where possible IUPAC #15, 153 and 209. To help assess the resolution of the separation chromatography, each mixture contains a pair of congeners which elute closely.

This set is designed to aid in the calibration of instruments used for the determination of chlorinated biphenyls.

Biological Tissue Reference Materials

(A) A lobster hepatopancreas reference material (TORT-1), with reliable values for 15 trace metals. The elements covered include V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Sr, Mo, Cd, Hg and Pb. Reliable values are also given for 7 minor elements: Na, Mg, P, S, Cl, K and Ca.

(B) A Northern shark liver tissue (DOLT-1) with reliable values for 12 trace elements. The elements covered include As, Cd, Co, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Se and Zn. Reliable values are also given for four minor elements: Cl, Mg, K and Na.

(C) A Northern shark muscle tissue (DORM-1) with reliable values for the same trace and minor elements as DOLT-1.

Suggested uses for these materials include calibration of instruments and control or checking of methods used for analysis of marine tissues.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (US-EPA)

The Quality Control Sample Program covers the ambient water quality, drinking water, water pollution, priority pollutant, hazardous and toxic waste programs for chemical, biological and micro-biological parameters. Most samples are prepared as concentrates in water or organic solvent (where noted) and sealed in glass ampuls. Instructions are provided for preparation of samples prior to analysis. The following samples are available now:

QC Samples for Water Quality Analyses

DEMAND ANALYSES	BOD, COD, and TOC
EPA/API STANDARD REFERENCE OILS	Arabian Light Crude Oil, Prudhoe Bay Crude Oil, South Louisiana Crude Oil, No. 2 Fuel Oil (high aromatics), and No. 6 Fuel Oil (high viscosity) Bunker C (laboratory must request specific oil)
LINEAR ALKYLATE SULFONATE	LAS, the anionic surfactant standard for the MBAS Test
MERCURY	mercury, two levels
MINERAL/PHYSICAL ANALYSES	sodium, potassium, calcium, magnesium, pH, sulfate, chloride, fluoride, alkalinity/acidity, total hardness, total dissolved solids, and specific conductance
NONIONIC SURFACTANT (CTAS TEST) STANDARD	Reference Nonionic Surfactant, $C_{12-18}E_{11}$ Standard Methods Method 512 C
NUTRIENTS	nitrate-N, ammonia-N, Kjeldahl-N, orthophosphate, and total P
OIL AND GREASE	analyzable by IR and gravimetrically
PESTICIDES IN FISH	toxaphene, DDD, DDE, and DDT
PHENOLS, TOTAL (4AAP Method)	total phenols in water
POLYCHLORINATED BIPHENYLS (PCBs) IN OILS	Aroclor 1016, 1242, 1254, and 1260 in transformer, hydraulic, and capacitor oils, (specify Aroclor and oil)
SUSPENDED SOLIDS	non-filterable, volatile and total filterable residue
TRACE METALS - WP I	aluminum, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc in 5% nitric acid
TRACE METALS - WP II	antimony, silver, and thallium in 5% nitric acid
TRACE METALS - WP III	barium, calcium, potassium, sodium, magnesium, and molybdenum in 5% nitric acid
TRACE METALS IN FISH	arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc
VOLATILE ORGANICS	chloroform, 1,2-dichloroethane, 1,1,1-trichloroethane, 1,1,2-trichloroethylene, carbon tetrachloride, 1,1,2,2-tetrachloroethylene, bromodichloromethane, dibromochloromethane, and bromoform in methanol

QC Samples for Priority Pollutants/Hazardous Wastes/Toxic Chemicals

n-ALKANES	dodecane, eicosane, heptadecane, hexacosane, tetradecane, tricosane in acetone
CHLORINATED HYDROCARBONS	hexachloroethane, hexachlorobenzene, 1,2,4-trichlorobenzene, o-dichlorobenzene, p-dichlorobenzene, m-dichlorobenzene, hexachlorobutadiene, 2-chloronaphthalene in acetone
CHLORINATED HYDROCARBON PESTICIDES - WP I	aldrin, dieldrin, DDT, DDE, DDD, and heptachlor in acetone
CHLORINATED HYDROCARBON PESTICIDES - WP II	chlordane in acetone
CHLORINATED HYDROCARBON PESTICIDES - WP III	alpha-BHC, beta-BHC, heptachlor epoxide, endrin, aldehyde, and alpha and beta endosulfan in acetone
CYANIDE, TOTAL	
DICHLOROBENZENES	3 Sets: meta and para isomers, meta and ortho isomers, and meta, ortho and para isomers in methanol
EP METALS	arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver in acetic acid
EP PESTICIDES & HERBICIDES	lindane, endrin, methoxychlor, 2,4-D, and Silvex in acetone
GC/MS ACIDS	2-chlorophenol, 2-nitrophenol, phenol, 2,4-dimethylphenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, 4-chloro-3-methylphenol, pentachlorophenol, and 4-nitrophenol in methanol
GC/MS BASE NEUTRALS - I	bis-2-chloroethyl ether, 1,3-dichlorobenzene, 1,2-dichlorobenzene, nitrosodipropylamine, isophorone, bis-2-chloroethoxy methane, 1,2,4-trichlorobenzene, hexachlorobutadiene, 2-chloronaphthalene, 2,6-dinitrotoluene, 2,4-dinitrotoluene, diethyl phthalate, hexachlorobenzene, phenanthrene, dibutyl phthalate, pyrene, benzo(a)anthracene, dioctyl phthalate, benzo(k)fluoranthene in methanol
GC/MS BASE NEUTRALS - II	1,4-dichlorobenzene, bis-2-chloroisopropyl ether, hexachloroethane, nitrobenzene, naphthalene, dimethyl phthalate, acenaphthene, fluorene, 4-chlorophenyl phenyl ether, 4-bromophenyl phenyl ether, anthracene, fluoranthene, butyl benzyl phthalate, benzo(a)pyrene, benzo(b)fluoranthene, benzo(a,h)anthracene, benzo(g,h,i) perylene in methanol
GC/MS BASE NEUTRALS - III	4-chlorobenzotrifluoride, m-chlorotoluene, 2,4-dichlorotoluene, 1,3,5-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,3,4-tetrachlorobenzene, 2,4,6-trichloroaniline, and pentachlorobenzene in acetone

GC/MS PESTICIDES - I	heptachlor, heptachlor epoxide, dieldrin, endrin, DDD, alpha BHC and gamma BHC
GC/MS PESTICIDES - II	beta-BHC, delta-BHC, aldrin, alpha and beta Endosulfan, 4,4'-DDE, and 4,4'-DDT in acetone
HALOETHERS	bis (2-chloroisopropyl) ether, bis (2-chloroethoxy) methane, bis (2-chloroethyl) ether, 4-chlorophenyl phenyl ether, 4-bromophenyl phenyl ether in acetone
ICAP - 19	As, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V and Zn in dilute nitric acid
ICAP - 7	Ag, Al, B, Ba, K, Na, and Si in dilute nitric acid
NITROAROMATICS AND ISOPHORONE	isophorone, nitrobenzene, 2,4-dinitrotoluene, and 2,6-dinitrotoluene in acetone
PHENOLS (GC)	phenol, 2,4-dimethylphenol, 2-chlorophenol, 4-chloro-3-methylphenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, pentachlorophenol, 2-nitrophenol, 4-nitrophenol, and 2,4-dinitrophenol in acetone
PHTHALATE ESTERS	dimethyl phthalate, diethyl phthalate, di-n-butyl phthalate, butyl benzl phthalate, diethyl hexyl phthalate and dioctyl phthalate in acetone
POLYCHLORINATED BIPHENYLS	separate samples available for Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260 in acetone (laboratory must request specific Aroclor needed)
POLYNUCLEAR AROMATICS - I	acenaphthene, anthracene, benzo(k)fluoranthene, chrysene, naphthalene, and pyrene in acetone
POLYNUCLEAR AROMATICS - II	acenaphthylene, 1,2-benzanthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, dibenzo(a,h) anthracene, fluoranthene, and phenanthrene in acetone

QC Samples for Drinking Water Analyses

CORROSIVITY/SODIUM	Langlier's Index Value and Sodium in water
HERBICIDES	2,4-D, 2,4,5-TP (Silvex) in methanol
NITRATE/FLUORIDE	nitrate-N and fluoride
CHLORINATED HYDROCARBON PESTICIDES - WS I	lindane, endrin, and methoxychlor in acetone
CHLORINATED HYDROCARBON PESTICIDES - WS II	toxaphene in acetone
RESIDUAL FREE CHLORINE	solvent is water
TEMIK	aldicarb, aldicarb sulfoxide, aldicarb sulfone in acetonitrile
TRACE METALS - WS	arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver in 5% nitric acid
TRIHALOMETHANES	chloroform, bromoform, dichlorobromomethane, and chlorodibromomethane in methanol
TURBIDITY	
VOLATILE ORGANIC CONTAMINANTS - I	benzene, ethylbenzene, m-xylene, n-propylbenzene, p-chlorotoluene, 1,3,5-trimethylbenzene and p-dichlorobenzene in methanol
VOLATILE ORGANIC CONTAMINANTS - II	trichloroethane, p-xylene, o-xylene, t-butylbenzene, p-cymene and n-dichlorobenzene in methanol
VOLATILE ORGANIC CONTAMINANTS - III	toluene, chlorobenzene, isopropylbenzene, sec-butylbenzene, 1,2,4-trimethylbenzene, n-butylbenzene, and o-dichlorobenzene in methanol
VOLATILE ORGANIC CONTAMINANTS - IV	1,1-dichloroethylene, cis-1,2-dichloroethylene, 1,1,1-trichloroethane, 1,1-dichloropropene, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethylene, and bis(2-chloroethyl) ether in methanol
VOLATILE ORGANIC CONTAMINANTS - V	bromochloromethane, chloroform, carbon tetrachloride, 1,1,2-trichloroethylene, 1,2-dibromoethane, 1,1,1,2-tetrachloroethane, pentachloroethane, 1,2-dibromo-3-chloropropane and m-dichlorobenzene in methanol
VOLATILE ORGANIC CONTAMINANTS - VI	dichloromethane, 1,1-dichloroethane, 1,2-dichloroethane, bromodichloromethane, 1,3-dichloropropane, 2-chloroethyl ethyl ether, 1,2,3-trichloropropane, chlorobenzene, bromobenzene and o-dichlorobenzene in methanol
VOLATILE ORGANIC CONTAMINANTS - VII	trichlorofluoromethane, trans 1,2-dichloroethane, dibromomethane, 1,2-dichloropropane, chlorodibromomethane, 1,1,2,2-tetrachloroethane, chlorohexane, o-chlorotoluene, and p-dichlorobenzene in methanol

QC Samples for Biology/Microbiology

ADENOSINE TRIPHOSPHATE (ATP)	three concentrations for use with luciferin-luciferase firefly bioluminescence assays; three ATP ampuls/set in tris buffer
ALGAE FOR IDENTIFICATION	Sample 1 contains two taxa and Sample 2 contains three taxa of preserved algae for microscopic identification. Instructions include the identifications of the algae. (laboratory must specify sample needed)
BACTERIA INDICATOR STRAINS	Enterobacter aerogenes, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa and Streptococcus faecalis, lyophilized (laboratory must request specific organisms needed). Also available are sterile lyophilized blanks for evaluation of aseptic technique.
CHLOROPHYLL	fluorometric analyses, three levels, in acetone
CHLOROPHYLL	spectrophotometric analyses, one level, in acetone
REFERENCE TOXICANTS	sodium lauryl sulfate, one level, aqueous solution; and cadmium chloride, one level, aqueous solution (laboratory must specify toxicant(s) needed)
SIMULATED PLANKTON	20 mL aqueous suspension of latex spheres for particle counting, and a permanent, glass slide mount of latex spheres for particle size distribution determinations

The US-EPA Repository for Toxic and Hazardous Materials

The EMSL-Cincinnati maintains the USEPA Repository for Toxic and Hazardous Materials to provide a continuing source of calibration materials, standards, reference compounds, spiking solutions for all trace organics of interest to the Agency.

Compounds are prepared individually as 1.5 ml solutions in water-miscible solvents sealed in all-glass ampuls. A data sheet with each ampul contains general chemical data, solution specifications, storage and preservation recommendations, information on purity and health hazards, and safe handling instructions.

Three grades of materials will be distributed:

- Quality Assurance Standards (QAS) 99 percent purity
- Quality Assurance Reagents (QAR) 95-98 percent purity
- Quality Assurance Technical Materials (QAT) 95 percent purity

The Repository will move as many compounds as possible from the QAT category by use of purification techniques. Exceptions are multicomponent materials such as PCBs, toxaphene, chlordane and halowaxes which will be categorized as QAR or QAT and will not be purified further.

The Current list of Repository materials distributed is given in the table to be found overleaf:

Concentrations are 5,000 ug of QAS-pure compound per mL of methanol solvent unless otherwise noted.

E001 Acenaphthene
E002 Acrolein**
E003 Acrylonitrile (10,000 ug/mL)
E004 Benzene
E005 Benzidine
E006 Chlorobenzene
E007 1,2,4-Trichlorobenzene
E008 Hexachlorobenzene (1000 ug/mL)*
E009 1,2-Dichloroethane
E010 1,1,1-Trichloroethane (10,000 ug/mL)(QAR)
E011 Hexachloroethane
E012 1,1-Dichloroethane (5,500 ug/mL)
E013 1,1,2-Trichloroethane (QAR)
E014 1,1,2,2-Tetrachloroethane (10,000 ug/mL)(QAR)
E015 Chloroethane (11,000 ug/mL)***
E016 bis(2-Chloroethyl) ether
E017 2-Chloroethyl vinyl ether (QAR)
E018 2-Chloronaphthalene
E019 2,4,6-Trichlorophenol
E020 p-Chloro-m-cresol
E021 Chloroform
E022 2-Chlorophenol
E023 1,2-Dichlorobenzene
E025 1,4-Dichlorobenzene
E026 3,3'-Dichlorobenzidine
E027 1,1-Dichloroethylene (1,000 ug/mL)
E028 trans-1,2-Dichloroethylene (11,500 ug/mL)
E029 2,4-Dichlorophenol
E030 1,2-Dichloropropane (10,000 ug/mL)
E033 2,4-Dinitrotoluene
E034 2,6-Dinitrotoluene
E036 Ethylbenzene (10,000 ug/mL)
E037 Fluoranthene
E038 4-Chlorophenyl phenyl ether
E039 4-Bromophenyl phenyl ether
E040 bis(2-Chloroisopropyl) ether (QAR)
E041 bis(2-Chloroethoxy) methane (QAR)
E042 Methylene chloride (10,000 ug/mL)
E043 Methyl chloride***
E044 Methyl bromide (9940 ug/mL)***
E046 Dichlorobromomethane
E047 Fluorotrichloromethane
E050 Hexachlorobutadiene (QAR)
E051 Hexachlorocyclopentadiene
E052 Isophorone
E053 Naphthalene
E054 Nitrobenzene
E055 2-Nitrophenol
E056 4-Nitrophenol
E057 2,4-Dinitrophenol (QAR)
E058 4,6-Dinitro-o-cresol
E059 N-Nitrosodimethylamine
E060 N-Nitrosodiphenylamine
E061 N-Nitrosodi-n-propylamine
E062 Pentachlorophenol
E063 Phenol
E064 bis(2-Ethyl hexyl) phthalate
E065 Butyl benzyl phthalate
E066 Di-n-butyl phthalate
E067 Di-n-octyl phthalate
E068 Diethyl phthalate
E069 Dimethyl phthalate
E070 Benzo(a)anthracene (1,000 ug/mL)
E071 Benzo(a)pyrene (1,000 ug/mL)(QAR)*
E072 Benzo(b)fluoranthene (2,500 ug/mL)*
E073 Benzo(k)fluoranthene (1,000 ug/mL)*
E074 Chrysene (1,000 ug/mL)*
E075 Acenaphthylene (QAR)
E076 Anthracene (1,000 ug/mL)*
E077 Benzo(g,h,i)perylene (1,000 ug/mL)**
E078 Fluorene (QAR)
E079 Phenanthrene
E081 Indeno(1,2,3-c,d)pyrene (500 ug/mL)*
E082 Pyrene (1,000 ug/mL)
E083 Tetrachloroethylene (10,000 ug/mL)
E084 Toluene (10,000 ug/mL)
E085 Trichloroethylene (10,000 ug/mL)
E088 Dieldrin (1,000 ug/mL)
EC89 Chlordane (QAT)
E091 4,4'-DDE
E092 4,4'-DDD
E093 alpha-Endosulfan (1,000 ug/mL)**
E094 beta-Endosulfan (1,000 ug/mL)**
E095 Endosulfan sulfate (1,000 ug/mL)(QAR)**
E096 Endrin (QAR)
E097 Endrin aldehyde
E098 Heptachlor
E099 Heptachlor epoxide
E100 alpha-BHC (2,500 ug/mL)
E101 beta-BHC (2,500 ug/mL)*
E102 gamma-BHC (Lindane)
E103 delta-BHC (1000 ug/mL)
E104 PCB-Aroclor 1242 (QAT)
E105 PCB-Aroclor 1254 (QAT)
E107 PCB-Aroclor 1232 (QAT)
E108 PCB-Aroclor 1248 (QAT)
E109 PCB-Aroclor 1260 (QAT)

*In Acetone **In para-Dioxane ***In 2-Propanol ****Acetonitrile
+Methylene chloride ++In Isooctane

Concentrations are 5,000 ug of QAS-pure compound per mL of methanol solvent unless otherwise noted. (continued)

E110 PCB-Aroclor 1016 (QAT)
E111 Toxaphene (QAT)
E124 4,4'-DDT (QAR)
E125 PCB-Aroclor 1016 (1,000 ug/mL)(QAT)++
E126 PCB-Aroclor 1221 (QAT)++
E129 PCB-Aroclor 1260 (500 ug/mL)(QAT)++
E129 PCB-Aroclor 1260 (1,000 ug/mL)(QAT)++
E129 PCB-Aroclor 1260 (3,000 ug/mL)(QAT)++
E130 PCB-Aroclor 1262 (QAT)++
E131 PCB-Aroclor 1268 (2,500 ug/mL)* (QAT)
E132 PCB-Aroclor 1242 (500 ug/mL)(QAT)++
E132 PCB-Aroclor 1242 (1,000 ug/mL)(QAT)++
E132 PCB-Aroclor 1242 (3,000 ug/mL)(QAT)++
E135 PCB-Aroclor 1254 (500 ug/mL)(QAT)++
E135 PCB-Aroclor 1254 (1,000 ug/mL)(QAT)++
E135 PCB-Aroclor 1254 (3,000 ug/mL)(QAT)++
E136 Bromochloromethane (10,000 ug/mL)
E149 2,4-Dichlorotoluene
E150 2-Chlorotoluene
E151 3-Chlorotoluene
E152 4-Chlorotoluene (QAR)
E153 4-Chlorobenzotrifluoride
E156 Pentachloronitrobenzene
E168 alpha,alpha,2,6-Tetrachlorotoluene
E169 Benzyl chloride (QAR)****
E170 2,3-Dichloro-1-propylene (10,000 ug/mL)
E171 1,2-Dibromoethane (EDB) (10,000 ug/mL)
E173 cis-1,2-Dichloroethylene (10,000 ug/mL)(QAR)
E175 1,2,3-Trichlorobenzene
E176 1,3,5-Trichlorobenzene
E177 1,2,4,5-Tetrachlorobenzene (2,500 ug/mL)(QAR)+
E179 2,4,5-Trichlorophenol (QAR)
E180 2,4,6-Trichloroaniline
E182 3-Chlorophenol
E183 4-Chlorophenol
E200 Chlorodibromomethane (10,000 ug/mL)(QAR)
E201 ortho-Xylene
E202 meta-Xylene
E203 para-Xylene
E212 Bromoform (10,000 ug/mL)(QAR)
E214 1,3-Dichlorobenzene
E218 cis & trans 1,3-Dichloropropylene (QAR)
E219 Mirex (1,000 ug/mL)*
E221 Aldrin
E222 2,3,5-Trichlorophenol (QAR)
E224 2,4-Dimethylphenol
E225 1,2,3,4-Tetrachlorobenzene (2,500 ug/mL)
E231 Dibenzo(a,h)anthracene (1,000 ug/mL)
E236 n-Decane
E237 n-Undecane
E238 n-Dodecane
E239 n-Tridecane
E240 n-Tetradecane
E241 n-Pentadecane
E242 n-Heptadecane (2,500 ug/mL)
E244 n-Nonadecane (1,000 ug/mL)
E246 n-Tetracosane (500 ug/mL)
E250 ortho-Cresol (QAR)
E251 meta-Cresol (QAR)
E252 para-Cresol
E255 Dibutyl ether
E257 Styrene
E258 Epichlorohydrin****
E260 Pentachlorobenzene (2,500 ug/mL)
E261 Dibenzofuran
E262 Diphenyl ether
E263 Diphenylamine
E270 Acrylamide (10,000 ug/mL)
E271 Pyridine (10,000 ug/mL)
E282 Diisodecyl phthalate
E284 Acetone
E285 Diethyl ether (4,500 ug/mL)
E286 1,2-Epoxybutane****
E295 Phenacetin
E298 N-Nitrosopyrrolidine
E299 2-Fluoroacetamide
E305 4-Chloroaniline
E311 Methyl ethyl ketone (10,000 ug/mL)
E322 Methylene bis (o-chloroaniline)
E324 o-Nitroaniline
E325 m-Nitroaniline
E329 Ethylenethiourea
E330 2,4-Dichlorophenoxyacetic acid (2,4-D)****
E334 N-Nitrosodiethylamine
E335 1,1,1,2-Tetrachloroethane (QAR)
E338 Propionitrile
E342 p-Nitroaniline
E349 4-Methyl-2-pentanone
E360 Carbon tetrachloride (10,000 ug/mL)
E363 Carbon disulfide
E368 1,2,3-Trichloropropane
E455 Dinoseb****
E470 PCN Halowax 1099 (QAT)
E471 PCN Halowax 1001 (QAT)
E472 PCN Halowax 1000 (QAT)

*In Acetone **In para-Dioxane ***In 2-Propanol ****Acetonitrile
+Methylene chloride ++In Isooctane

Concentrations are 5,000 ug of QAS-pure compound per mL of methanol solvent unless otherwise noted. (continued)

E473 Acetonitrile***
E480 para-Dioxane (10,000 ug/mL)
E536 Vinyl chloride***
E542 Aniline
E548 N,N-Dimethylformamide
E552 2,4,5-TP (Silvex) (QAR)****
E662 3-Nitrophenol
E713 Picloram (1000 ug/mL)****
E715 Carbofuran
E952 p,p'-Methoxychlor
E954 Aldicarb (1,000 ug/mL)****
E993 1,2-Dibromo-3-chloropropane
E995 Aldicarb sulfone (1,000 ug/mL)****
E996 Aldicarb sulfoxide (1,000 ug/mL)****
E1089 Alachlor (1,000 ug/mL)
E1097 Dibromomethane

Surrogates and Internal Standard for USEPA GC/MS Methods 624 and 625

E188 Phenanthrene - d_{10} (150 ug/mL)
E189 Phenol - d_5 (100 ug/mL)*
E190 2,4-Dimethylphenol-3,5,6-d_3 (QAR)(100 ug/mL)*
E191 Pentachlorophenol-$^{13}C_6$ (100 ug/mL)*
E192 Dimethyl phthalate - d_6 (150 ug/mL)*
E193 2-Fluorophenol (QAR) (100 ug/mL)*
E194 2-Fluorobiphenyl (100 ug/mL)*
E195 1-Fluoronaphthalene (100 ug/mL)*
E196 1,4-Dichlorobutane-d_8 (150 ug/mL)
E197 2-Bromo-1-chloropropane-d_6 (150ug/mL)(QAT
E198 Bromochloromethane-d_2 (150 ug/mL)
E199 Benzo(g,h,i)perylene-$^{13}C_{12}$(100 ug/mL)*
E232 Fluorobenzene (150 ug/mL)
E233 4-Bromofluorobenzene (150 ug/mL)
E234 4,4-Dibromooctafluorobiphenyl (100 ug/mL)
E776 1,2-Dichlorobenzene-d_4 (150 ug/mL)

*In Acetone **In para-Dioxane ***In 2-Propanol ****Acetonitrile
+In Methyl Chloride ++In Isooctane

Samples can be obtained from:

US Environmental Protection Agency
QA Branch, EMSC-Cincinnati
Cincinnati, Ohio 45268
USA

NATIONAL BUREAU OF STANDARDS, USA

Status of Certified Reference Material at NBS useful to the marine science community.

The tabulation of Standard Reference Materials prepared for the meeting in Washington D.C. contains most of the materials of interest to the marine science community.

Since the tabulation was prepared, several Standard Reference Materials of potential interest to the community have been undertaken. These are listed below.

Standard Reference Materials currently being prepared

SRM	TBA	PCB's on Fresh Water Sediment (2)
SRM	TBA	Marine sediment certified for PCB's (ppb level) PAH's(ppm level), pesticides(ppb level)
SRM	TBA	Calibration solution (hexane) contains approximately 17 PAH's, 20 pesticides and PCB's selected congeners
SRM	TBA	Fresh water sediment for trace elements.

NATIONAL INSTITUTE OF OCEANOGRAPHY, UK

Standard reference material being produced:

IAPSO Standard Seawater.

INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)

Analytical Quality Control Services (AQCS)

The IAEA, through its laboratory in Seibersdorff and its International Laboratory of Marine Radioactivity in Monaco, endeavours to assist its Member States to maintain high standards of analytical performance by issuing reference materials and by conducting intercomparison and intercalibration exercises between laboratories throughout the world. Particular attention is given in the Monaco laboratory to materials of marine origin.

The parameters for which marine reference materials and intercomparison samples have been prepared include national and man-made radionuclides, organochlorine compounds, trace elements (particularly the "heavy metals").

Currently available materials for the various analytes are shown in the attached table as are the plans for materials for distribution in the near future.

Samples may be ordered from:

IAEA
Analytical Quality Control Services (AQCS)
P O Box 10
A-1400 Vienna
AUSTRIA

Details on participation in intercomparison exercises may be obtained from:

IAEA/ILMR
Musee Oceanographique
Principaute de Monaco

A. Reference Materials

SD-N-1/1	Sediment	Radionuclide
SD-N-1/2	Sediment	Trace elements Natural radionuclides
SD-N-2	Sediment	Man-made and natural radionuclides
AG-B-1	Marine algae	Man-made and natural radionuclides
MA-A-1/TM	Dried Copepoda	Trace elements
MA-A-1/OC	Dried Copepoda	Chlorinated hydrocarbons (9 compounds)
MA-A-1/TM	Fish flesh homogenate	Trace elements
MA-A-2/OC	Fish flesh homogenate	Chlorinated hydrocarbons (8 compounds)
MA-M-1/OC	Oyster homogenate	Chlorinated hydrocarbons (7 compounds)
MA-M-2/TM	Mussel Tissue	Trace elements
MA-M-2/OC	Mussel Tissue	Chlorinated hydrocarbons

B. Intercomparison Materials

MA-B-3/TM	Shrimp Tissue	Trace elements
MA-B-3/OC	Shrimp Tissue	Chlorinated hydrocarbon
SD-A-1	Sediment	Man-made and Natural Radionuclides

C. In preparation (Intercomparison Materials) probably more appropriately termed "uncompromised materials"

(i) one marine algae (Mediterranean) and one sediment (Baltic Sea) currently in preparation for man-made radionuclides;

(ii) two further samples (sediment and fish flesh) expected to be prepared before mid-1987 for trace elements and organochlorines.

COMMUNITY BUREAU OF REFERENCE (BCR), EEC

New materials to be included in the present list of reference materials:

(i) Al is now certified in our plant materials (including aquatic moss and an aquatic plant);

(ii) pcb congeners in two fish oils will be certified in 1987;

(iii) trace elements in seaweed (Ulva) and mussel tissue will be certified in 1987;

(iv) certification work on pcb in sludge will be started in 1987;

(v) a group to prepare analytical work on harbour sediment (OC-pesticides, pah's and pcb's) has been formed.

NATIONAL INSTITUTE FOR ENVIRONMENTAL STUDIES, TSUKUBA, JAPAN

NIES has prepared the following environmental and biological reference materials for use in elemental analysis.

No. 1	Pepperbush	CRM	(14 g)	Certified for 16 elements
No. 2	Pond Sediment	CRM	(20 g)	Certified for 13 elements
No. 3	Chlorella	CRM	(36 g)	Certified for 9 elements
No. 4	Freeze-dried Human Serum	RM*	(10 vials)	
No. 5	Human Hair	CRM	(2 g)	Certified for 13 elements
No. 6	Mussel	CRM	(10 g)	Certified for 14 elements
No. 7	Tea Leaves	CRM	(22 g)	Certified for 11 elements
No. 8	Vehicle Exhaust Particulates	CRM	(7 g)	Certified for 15 elements
No. 9	Sargasso Seaweed	RM	(10 g)	
No. 10	Rice Flour-Unpolished	RM**	(60 g x 3)	

* Candidate reference material
** set of 3 bottles containing different levels of Cd

NIES is planning to prepare reference materials for use in metal speciation and will start shortly feasibility studies concerning preparation, preservation, analysis, etc. Candidate materials are:

1. Mercury Compounds in Fish Flesh	Methylmercury, Inorganic Hg
2. Mercury Compounds in Human Hair	Methylmercury, Inorganic Hg
3. Arsenic Compounds in Marine Organisms	Arsenobetaine,, Arsenosugars Inorganic As
4. Arsenic Compounds in Air Particulate Matter	Dimethyl and trimethyl forms of arsenic
5. Tin Compounds in Marine Sediment	bis(tributyltin)oxide, tributyltin fluoride,

ANNEX V

REFERENCE METHODS FOR MARINE POLLUTION STUDIES

title	ref. no.	language
UNEP/WHO: Guidelines for monitoring the quality of coastal recreational and shellfish-growing waters. (Draft) Reference Methods for Marine Pollution Studies No. 1. UNEP 1984. (33 pages)	RSRM. 1	E
UNEP/WHO: Determination of total coliforms in sea-water by the membrane filtration culture method. Reference Methods for Marine Pollution Studies No. 2 Rev. 1. UNEP 1983. (19 pages)	RSRM. 2	E,F
UNEP/WHO: Determination of faecal coliforms in sea-water by the membrane filtration culture method. Reference Methods for Marine Pollution Studies No. 3 Rev. 1. UNEP 1983. (20 pages)	RSRM. 3	E,F
UNEP/WHO: Determination of faecal streptococci in seawater by the membrane filtration culture method. Reference Methods for Marine Pollution Studies No. 4 Rev. 1. UNEP 1983. (18 pages)	RSRM. 4	E,F
UNEP/WHO: Determination of faecal coliforms in bivalves by multiple test tube method. Reference Methods for Marine Pollution Studies No. 5 Rev. 1. UNEP 1983. (15 pages)	RSRM. 5	E,F
UNEP/FAO/IAEA: Guidelines for monitoring chemical contaminants in marine organisms. Reference Methods for Marine Pollution Studies No. 6. (in preparation)	RSRM. 6*	E
UNEP/FAO/IOC/IAEA: Sampling of selected marine organisms and sample preparation for trace metal analysis. Reference Methods for Marine Pollution Studies No. 7 Rev. 2. UNEP 1984. (15 pages)	RSRM. 7	E
UNEP/FAO/IOC/IAEA: Determination of total mercury in selected marine organisms by cold vapour atomic absorption spectrophotometry. Reference Methods for Pollution Studies No. 8 Rev. 1. UNEP 1984. (13 pages)	RSRM. 8	E
UNEP/FAO/IAEA: Determination of total arsenic in selected marine organisms by hydride generation atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 9. UNEP 1985. (11 pages)	RSRM. 9	E

title	ref. no.	language
UNEP/FAO/IAEA: Determination of total selenium in selected marine organisms by hydride generation atomic absorption spectrophotometry. Reference Methods for Marine Pollution Studies No. 10. UNEP 1984. (12 pages)	RSRM. 10	E
UNEP/FAO/IOC/IAEA: Determination of total cadmium, zinc, lead and copper in selected marine organisms by flameless atomic absorption spectrophotometry. Reference Methods for Marine Pollution Studies No. 11 Rev. 1. UNEP 1984. (18 pages)	RSRM. 11	E
UNEP/FAO/IAEA: Sampling of selected marine organisms and sample preparation for the analysis of chlorinated hydrocarbons. Reference Methods for Marine Pollution Studies No. 12 Rev. 1. UNEP 1984. (15 pages)	RSRM. 12	E
UNEP/FAO/IAEA: Determination of methylmercury in selected marine organisms by gas chromatography. Reference Methods for Marine Pollution Studies No. 13. UNEP 1984. (12 pages)	RSRM. 13	E
UNEP/FAO/IAEA: Determination of DDTs and PCBs in selected marine organisms by gas-liquid chromatography. Reference Methods for Marine Pollution Studies No. 14 (Rev.1) UNEP 1982. (20 pages)	RSRM. 14*	E
UNEP/IOC/IAEA: Monitoring of tar on marine beaches. (Draft) Reference Methods for Marine Pollution Studies No. 15. UNEP 1985. (9 pages)	RSRM. 15	E
UNEP/IAEA: Determination of DDTs, PCBs, PCCs and other hydrocarbons in sea-water by gas chromatography. (Draft) Reference Methods for Marine Pollution Studies No. 16. UNEP 1982. (8 pages)	RSRM. 16	E
UNEP/IAEA: Determination of DDTs, PCBs and other hydrocarbons in marine sediments by gas-liquid chromatography. (Draft) Reference Methods for Marine Pollution Studies No. 17. UNEP 1982. (10 pages)	RSRM. 17	E
UNEP/IOC: Determination of total dissolved cadmium in seawater by differential pulse anodic stripping voltammetry (Draft) Reference Methods for Marine Pollution Studies Studies No. 18. UNEP 1983. (7 pages)	RSRM. 18	E

title	ref. no.	language
UNEP/IOC/IAEA: Determination of mercury in estuarine waters and suspended sediment by cold vapour atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 19. UNEP 1985. (14 pages)	RSRM. 19	E
UNEP/IOC/IAEA: Monitoring of petroleum hydrocarbons in sediments. Reference Methods for Marine Pollution Studies No. 20. (in preparation)	RSRM. 20*	E
UNEP/WHO/IAEA: Determination of total coliforms in seawater by multiple test tube (MPN) method. (Draft) Reference Methods for Marine Pollution Studies No. 21. UNEP 1985. (17 pages)	RSRM. 21	E
UNEP/WHO/IAEA: Determination of faecal coliforms in sea-water by multiple test tube (MPN) method. (Draft) Reference Methods for Marine Pollution Studies No. 22. UNEP 1985. (20 pages)	RSRM. 22	E
UNEP/WHO/IAEA: Determination of faecal streptococci in sea-water by multiple test tube (MPN) method. (Draft) Reference Methods for Marine Pollution Studies No. 23. UNEP 1985. (17 pages)	RSRM. 23	E
UNEP/WMO/IAEA: Sampling of aerosols and wet precipitation for analysis of chemical pollutants. (Draft) Reference Methods for Marine Pollution Studies No. 24. UNEP 1985. (18 pages)	RSRM. 24	E
SPC/UNEP: Coral reef monitoring handbook. Reference Methods for Marine Pollution Studies No. 25. UNEP 1984. (21 pages)	RSRM. 25	E
UNEP/IAEA: Determination of total mercury in marine sediments and suspended solids by cold vapour atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 26. UNEP 1985. (11 pages)	RSRM. 26	E
UNEP/IAEA: Determination of total cadmium in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 27. UNEP 1985. (9 pages)	RSRM. 27	E
UNEP/WHO/IAEA: Determination of staphylococcus aureus in sea-water and sewage by the membrane filtration culture method. Reference Methods for Marine Pollution Studies No. 28. UNEP 1986. (18 pages)	RSRM. (28)	E

title	ref. no.	language
UNEP/WHO/IAEA: Determination of pseudomonas aeruginosa in sea-water and sewage by the membrane filtration culture method. Reference Methods for Marine Pollution Studies No. 29. (in preparation)	RSRM. 29*	E
UNEP/WHO/IAEA: Isolation/Enumeration of salmonella from sea-water and sewage. Reference Methods for Marine Pollution Studies No. 30. (in preparation)	RSRM. 30*	E
UNEP/IAEA: Determination of total chromium in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 31. UNEP 1985. (9 pages)	RSRM. 31	E
UNEP/IAEA: Determination of total cobalt in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 32. UNEP 1985. (9 pages)	RSRM. 32	E
UNEP/IAEA: Determination of total copper in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 33. UNEP 1985. (9 pages)	RSRM. 33	E
UNEP/IAEA: Determination of total lead in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 34. UNEP 1985. (9 pages)	RSRM. 34	E
UNEP/IAEA: Determination of total nickel in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 35. UNEP 1985. (9 pages)	RSRM. 35	E
UNEP/IAEA: Determination of total vanadium in marine sediments by flameless atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 36. UNEP 1985. (9 pages)	RSRM. 36	E
UNEP/IAEA: Determination of total iron in marine sediments by flame atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 37. UNEP 1986. (10 pages)	RSRM. (37)	E
UNEP/IAEA: Determination of total manganese in marine sediments by flame atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 38. UNEO 1986.(10 pages)	RSRM. (38)	E
UNEP/IAEA: Determination of total zinc in marine sediments by flame atomic absorption spectrophotometry. (Draft) Reference Methods for Marine Pollution Studies No. 39. UNEP 1986.(10 pages)	RSRM. (39)	E

ANNEX VI

GLOSSARY OF TERMS

REFERENCE MATERIALS

A material containing one or more analytes for which the concentrations are sufficiently well established for its intended use.

Within this generic description are the following classifications:

Certified Reference Materials (CRM's)

A material containing one or more analytes for which the concentrations are known and have been certified by the producing organizations by two or more independent analytical methods, or a definitive method.

Research Materials

A material containing one or more analytes for which concentrations are given on the basis of consensus values arising from the analytes of this material by a number of laboratories.

Intercomparison Materials

A homogeneous material containing one or more analytes that has been specially prepared for use in intercomparison exercises. The concentrations of the analytes are not disclosed to the user.

Standards

A synthetic material of known priority prepared for the calibration of instruments or intercomparison of measurements.