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UNEP/FAO/WHO Meeting of Experts on Environmental Quality Criteria for Mercury in Mediterranean Seafood

Geneva, 3 - 6 November 1980

D R A F T R E P O R T

OF THE UNEP/FAO/WHO MEETING OF EXPERTS ON ENVIRONMENTAL QUALITY CRITERIA FOR MERCURY IN MEDITERRANEAN SEAFOOD

INTRODUCTION

1. The First Meeting of Contracting Parties to the Barcelona Convention (Geneva, 5 - 10 February 1979) endorsed the development of environmental quality criteria in the framework of the Mediterranean Action Plan. It was stated in particular that:

2. "Work should be continued on the development of the scientific rationale for the criteria applicable to the quality of recreational waters, shellfish-growing areas, waters used for aquaculture, and seafood. Based on this rationale and taking into account existing national provisions and international arrangements and agreements, the criteria should be formulated on a scientific basis and submitted to the Governments and the EEC for their consideration." (UNEP/IG/14/9, Annex V, paragraph 13).

3. The meeting of the Bureau of the Contracting Parties (Geneva, 26 - 27 June 1979) considered the matter and urged the secretariat to take steps in developing the environmental quality criteria for bathing waters and mercury in seafood.

4. Interagency consultations were held in November and December 1979 on the design and implementation of a co-operative programme on health-related aspects of mercury levels in edible marine organisms. The objectives of such a programme were formulated as follows:

(i) To obtain reliable information on mercury contents in fish and shellfish in various parts of the Mediterranean region;

(ii) To establish patterns of consumption of fish and shellfish in selected communities around the Mediterranean and to identify high risk groups;

(iii) To gather epidemiological information on health effects in high and low risk groups and general populations;

(iv) To review the recommended national and international limits and guidelines for mercury levels and intake by man in the light of latest available information and in relation to consumption patterns of fish and shellfish in the Mediterranean region;

(v) To establish environmental and health monitoring systems and to recommend safeguards and measures for the reduction and control of exposure to mercury from consumption of fish and shellfish.

5. In view of the necessity to provide the Member States of the Mediterranean region with advice related to consumption of mercury-contaminated seafood prior to the meeting on the long-term monitoring and research programme, it was agreed to undertake preparatory activities as follows:

   (i) Compilation and evaluation of data on concentration of mercury in seafood;

   (ii) Collection, evaluation and interpretation of available data on seafood consumption patterns, giving emphasis to high exposure groups, including results of pilot studies in selected countries;

   (iii) Collection of available data on mercury levels in blood and other tissues and, if possible, augmentation of these data by biological monitoring of selected groups;

   (iv) Review of latest available data on health effects of mercury in seafood, with particular reference to dose-response relationships;

   (v) Review of national legislation and enforcement practices related to the subject;

   (vi) Updating the data profiles on mercury.

6. Most of these tasks were completed prior to the present meeting and the results are included in the documentation prepared for the meeting.

Scope and purpose of the meeting

7. The present meeting is expected, in particular, to:

   (i) evaluate the hazards related to the intake of mercury by populations through seafood in the Mediterranean region; and

   (ii) develop recommendation(s) on desirable environmental quality criteria for mercury in Mediterranean seafood.

8. The results of the present meeting will provide a direct input to the Meeting of Experts to Evaluate the Pilot Phase of MED POL and to Develop a Long-term Monitoring and Research Programme for the Mediterranean Action Plan (Geneva, 12 - 16 January 1981). This programme for the second phase of MED POL is expected to contain major components related to the monitoring of mercury as well as for research on the health effects of hazardous substances listed in the legal agreements adopted as part of the Mediterranean Action Plan.

Attendance

9. The meeting was convened jointly by the United Nations Environment Programme, the Food and Agriculture Organization of the United Nations, and the World Health Organization. In addition to financial support from the Mediterranean Trust Fund under the MED POL programme, the International Programme on Chemical Safety supported the participation of several experts. Consequently, Mediterranean aspects as well as experience with mercury incidences in other parts of the world were covered.

10. A complete list of participants is attached as annex I to this report.

Agenda Item 1 : Opening of the meeting

11. Mr. Stjepan Keckes, Director, UNEP Regional Seas Programme Activity Centre, opened the meeting on behalf of the co-sponsoring agencies while Dr. Hasegawa conveyed the welcome of WHO to the meeting.

12. The great concern of the Mediterranean Governments regarding the problem and consequences of the mercury levels in local seafood was conveyed by Mr. Keckes in his opening remarks. Guidance on this complex question from the scientific institutions and experts is most needed in order to take the necessary administrative and legal measures.

Agenda Item 2 : Organization of the meeting

13. The meeting unanimously elected the following officers:

Chairman: Prof. F. Pocchiari

Vice-Chairman: Prof. T. W. Clarkson

Rapporteur: Mr. M. J. Inskip

14. It was agreed to conduct the meeting in plenary and to establish ad hoc working groups as deemed necessary.

Agenda Item 3 : Adoption of the agenda

15. The meeting adopted the agenda contained as annex II to this report.

Agenda Item 4 : Review of results obtained from recent expert meetings and studies

16. In preparation of the meeting, expert consultations were convened and studies and reviews were undertaken by various institutions

and organizations. Their results are contained in the documentation listed as annex III to this report. Each part was introduced by the participants involved in their preparation. A brief discussion followed their introduction. A paper by Bernhard and Renzoni was added to the list due to its relevance to the deliberations of the group.

Agenda Item 5 : Assessment of presently available knowledge on the problem and identification of existing gaps

Agenda Item 6 : Evaluation of hazards related to the intake of mercury by populations through seafood in the Mediterranean Region

17. The group agreed that these two items should be considered together. Based on the information available, present knowledge was reviewed along with the indentification of existing gaps particularly in relation to the Mediterranean region. An evaluation of health hazards through the consumption of Mediterranean seafood was made difficult due to the very limited data for those groups considered likely to have an increased methylmercury intake.

18. The group considered that the information required for such an evaluation includes the following:

1. Whether methylmercury in seafood presents a hazard to human health.

2. The relative contributions of natural and anthropogenic sources of mercury to methylmercury intake by humans.

3. The typical levels of methylmercury in Mediterranean seafood.

4. The size of the human populations whose methylmercury intake exceeds the WHO Provisional Tolerable Weekly Intake (PTWI)*.

5. The levels of methylmercury intake by these populations.

6. The levels of mercury in human beings around the Mediterranean.

7. Health effects associated with methylmercury intake from Mediterranean seafood.

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*200 ug methylmercury per 70 kg person per week

19. The group recognized that the intake of methylmercury in seafood may constitute a health hazard (UNEP/MED-HG/11 and 12).

20. Natural mercury anomalies were considered likely to provide the predominant input of mercury into the Mediterranean Sea, overall. However, there may be a number of local areas where anthropogenic contributions are significant (UNEP/MED-HG/13).

21. In the light of available evidence, table 1 in UNEP/MED-HG/12 was accepted as providing data typical for the concentration of methylmercury in Mediterranean seafood. However, these estimates do not reflect concentrations in hotspot areas. Furthermore, there is highly uneven geographical distribution in the availability of data on mercury in species used as seafood. For some species of marine organisms used as seafood there are limited data on their mercury concentrations.

22. On the basis of the best available data, the group assumed that most of the general population has low methylmercury intake and is therefore not at risk. The two following hypothetical calculations based on table 1 in UNEP/MED-HG/12 were considered:

23. For the majority of seafoods (excluding certain species of tuna, swordfish and elasmobranchs for example), an average methylmercury content of up to 300 ug/kg wet weight is assumed; one meal of 150 g would be equivalent to a methylmercury intake of 45 ug. For a 70 kg B.W. adult, this would mean that with an intake of less than four fish meals per week, the WHO PTWI would not be exceeded (it was considered necessary to allow up to 10-20 per cent of the PTWI for methylmercury intake from other sources).

24. For 'predatory fish' (including tuna, swordfish and elasmobranchs) an average methylmercury content of up to 1800 ug/kg is assumed; one meal of 150 g would be approximately equivalent to a methylmercury intake of 270 ug. In this case, therefore, fish consumption would have to be less than one meal per week to give an intake below the WHO PTWI (UNEP/MED-HG/11 and 12).

25. Calculations for low body weight adults and children need to be based on the correspondingly reduced PTWI figures.

26. Although the hypothetical calculations above suggest a low methylmercury intake for the general population, it was considered that the following groups have high methylmercury intake which may, in some cases, exceed the WHO PTWI:

    1. Fishermen and their families.

2. Employees of the fish industry and their families.

3. Employees of fish restaurants and their families.

4. Consumers of seafood with especially high concentrations of methylmercury (see calculation in 24. above).

27. Within these groups, special attention needs to be paid to women of child-bearing age as pre-natal life is the most sensitive stage of the lifecycle to methylmercury.

28. Provisional data are only available for fishermen of group 1. above (excluding their families) and suggest a total Mediterranean population of about 350,000 (FAO/OECD Country Profiles). Data are not available on the size of the other groups.

29. There are very limited data available on the level of methylmercury intake by the above groups. Data from Italy suggest that some intakes may be up to 3.5 ug/kg body wt/day (UNEP/MED-HG/7).

30. Actual measurements by biological monitoring of mercury in blood of such populations in Italy have ranged up to 400 ng/ml RBC (red blood cells). This corresponds to levels of up to 200 ng/ml of whole blood. In addition, some data are also available from Yugoslavia, but were not presented to the group. Data from Mediterranean countries were not known to be available.

31. The few studies undertaken have not detected health effects due to methylmercury intake through seafood (UNEP/MED-HG/3). However, this does not exclude the possibility of cases of mild methylmercury poisoning in the studied areas.

32. Thus, the main gaps in knowledge can be summarized as follows:

1. Biological monitoring data on mercury levels in populations with high methylmercury intakes.

2. The patterns of seafood consumption in various sectors of the Mediterranean area, including seasonal variations.

3. Anthropogenic sources of mercury and other selected pollutants and their contributions to methylmercury in fish.

4. Methylmercury concentrations in various types of seafood in certain sectors of the Mediterranean Sea.

5. Identification of populations with relatively high methylmercury intake and estimation of their size.

Item 7 : Development of recommendations on desirable environmental quality criteria for mercury in Mediterranean seafood

33. The group acknowledged that the WHO PTWI of 200 ug methylmercury/ week per 70 kg 'standard person' remains a valid recommendation, in the light of available data.

34. There are indications that pre-natal life is more sensitive to methylmercury (WHO, 1980) and the group strongly recommends that further research be directed towards the recognition of any early health affects associated with low levels of exposure.

35. On this basis, and in the light of available data on fish consumption in the Mediterranean area and concentration of methylmercury reported in fish, the group considers that a part of the population in the Mediterranean area may have an intake of methylmercury, through seafood, which exceeds the WHO PTWI. However, the major part of the population is believed to have an intake below the WHO PTWI.

36. Therefore, the group recommends that the total intake of methylmercury through seafood should be limited to protect groups believed to exceed the WHO PTWI.

37. In principle, this may be achieved through various options:

(a) Advice on dietary intake, including:

(i) choice of fish species;
(ii) frequency and number of fish meals;
(iii) other sources of protein.

(b) The establishment of standards which limit the mercury concentration in:

(i) all seafood; or
(ii) selected species used as seafood.

(c) Restrictions on the size of fish allowed for consumption, for certain species in which mercury concentrations are known to be a function of fish size.

(d) The banning or limitation of fishing in certain areas for (all/selected) species used as seafood.

(e) Limitation of anthropogenic discharges.

38. Member States have to choose from these or any other possibilities, evaluating the efficacy, costs and benefits of alternative actions for each of the specific situations.

39. The group considered that the information listed below will significantly assist in selecting and formulating the appropriate action.

1. Evaluation of all available data to select populations likely to have a high intake of methylmercury.

2. Studies of mercury levels in hair in the populations thus selected, to identify groups whose methylmercury intake exceeds the WHO PTWI.

3. For each group thus identified, further studies should be performed to determine:

   (i) the size of the group(s);
   (ii) the patterns of individual consumption of seafood;
   (iii) the actual concentrations of methylmercury in the various species consumed.

4. As the human foetus is considered to be the most sensitive target, special attention should be given to the estimation of methylmercury intake by pregnant women.

40. A more detailed outline of this proposed study is contained in annex IV.

41. It was considered that the effectiveness of any governmental regulatory actions mentioned above would need to be evaluated by follow-up biological monitoring of hair for mercury.

42. The group recognizes that there are special difficulties in connection with the analysis of mercury in biological materials such as hair. The group, therfore, recommends that action needs to be taken to ensure the availability of adequately equipped and controlled analytical laboratories, along with trained personnel.

43. The group considered that the effectiveness of the actions, recommended in the three preceding paragraphs, would be enhanced by co-ordination through, and assistance of, the appropriate international organizations.

Agenda Item 8 : Other business

44. The group recognized the complex nature of the problem faced by those at the decision-making level. They also recognized that the implementation of any regulatory actions taken by Governments may have important social, economic and legal implications at the local, regional or national level.

45. Because of these factors, it was considered important to convene a future meeting where all such aspects and implications could be discussed more fully.

Agenda Item 9 : Adoption of the report

46. The group agreed that the draft document would be circulated; all comments considered relevant would be incorporated into the final version by the chairman, vice-chairman and rapporteur before its formal submission.

47. The report will be used by the secretariat (UNEP/FAO/WHO) to formulate a proposal for draft environmental quality criteria for mercury in Mediterranean seafood which will be submitted for review to the Meeting of Experts on MED POL (see paragraph 8 of this document) and to the Second Meeting of Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution and its Related Protocols (March 1981) for further consideration.

Agenda Item 10 : Closure of the meeting

48. The meeting closed at 1700 hours on 6 November 1980.

ANNEX I

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ANNEX II

AGENDA

1. Opening of the meeting
2. Organization of the meeting
3. Adoption of the agenda
4. Review of results obtained from recent expert meetings and studies
5. Assessment of presently available knowledge on the problem and identification of existing gaps
6. Evaluation of hazards related to the intake of mercury by populations through seafood in the Mediterranean region
7. Development of recommendations on desirable environmental quality criteria for mercury in Mediterranean seafood
8. Other business
9. Adoption of the report
10. Closure of the meeting

ANNEX III

LIST OF DOCUMENTS

UNEP/MED-HG/1	Provisional Agenda
UNEP/MED-HG/2	Annotated Provisional Agenda
UNEP/MED-HG/3	Provisional List of Documents
UNEP/MED-HG/4	Provisional List of Participants
UNEP/MED-HG/5	Draft Long-term Programme for Pollution Monitoring and Research in the Mediterranean (MED POL - PHASE II)
UNEP/MED-HG/6	Mercury Levels in Selected Marine Organisms from the Mediterranean; FAO, 1980
UNEP/MED-HG/7	Pilot Study on the Chance of Italian Seafood Consumers of Exceeding their Individual Daily Allowable Mercury Intake; FAO, 1980
UNEP/MED-HG/8	Preliminary Results of Biological Monitoring of Selected Populations in Italy; Paccagnella, 1980
UNEP/MED-HG/9	Health Effects of Methylmercury. Progress Report 1975-1979 (Second draft); MARC Technical Report, 1980
UNEP/MED-HG/10	Data Profile on Mercury (with special emphasis on data from the Mediterranean region); IRPTC, 1980
UNEP/MED-HG/11	Environmental Health Criteria 1 - Mercury; WHO, 1978
UNEP/MED-HG/12	Report on Consultation to Re-examine the WHO Environmental Health Criteria for Mercury, Geneva, 21-25 April 1980
UNEP/MED-HG/13	Mercury Concentration in Mediterranean Marine Organisms and in their Environment Natural or Anthropogenic Origin; by Bernhard M. and Renzoni A; Thalassia Jugoslavia, 13 (1977), pp. 265-300.

ANNEX IV

PROPOSED STUDY ON HAZARD ASSESSMENT

Phase I : Assessment of exposure to methylmercury

1. In order to obtain reliable figures on the exposure to methylmercury, it is important to select a sufficient number of representative villages having similar fishing patterns, local ecologies and lifestyles. The ongoing MED POL programme (UNEP/MED-HG/6) may also give guidance by locating 'hotspots' (defined below in paragraph 13) where elevated methylmercury levels occur in fish and shellfish species.

2. Families believed to have the highest fish consumption should have priority for sampling. The number of families sampled will be determined by local conditions but should be sufficient to allow adequate statistical analysis. Usually all members of the family will be sampled but, should this not be possible, every effort should be made to sample the women of childbearing age.

3. Employees of the fish restaurants and their families believed to have high fish consumption should also be sampled. Other groups having high fish consumption should also be identified, wherever possible.

Hair sampling

4. The analysis of samples of head hair offers the best means of determing seasonal exposure to methylmercury (UNEP/MED-HG/11 and 12). The hair sample should be collected and analysed in several ways so as to allow sufficient accurate recapitulation of past exposures, to indicate seasonal variations. These procedures have been described in detail and applied to epidemiological studies (Greenwood, et al. 1978, Wheatley 1979, McGill report 1980, Phelps et al. 1980). These and other studies using this technique have been evaluated by WHO (UNEP/MED-HG/11 and 12).

5. The group agreed that blood sampling was not necessary in phase I.

6. Each sampling should involve the completion of a simple one page questionnaire form. The information should be sufficient to give unique identification of the person, the area, and data of sampling, and fish consumption during the last two weeks if possible.

7. Special attention should be paid to collection, storage and transportation and analysis of the hair samples. The detailed organization of the details for analysis of the hair may differ depending on the resources and decisions at the international as well as the national level. Thus the decision may be to have one central laboratory for the whole region and general laboratories at national and subregional levels. The group stresses that the method should be standardized and a strong quality control (inter-laboratory comparison) must be instituted before the start of phase I. The quality control should be maintained throughout the study.

8. Phase I - The data from phase I will indicate the upper range of daily intake, the seasonal variation, peak level attained, and individuals or sub-groups having highest levels of mercury.

9. In view of the crucial importance of the group to be selected, the data processing and interpretation and the generally difficult and complicated nature of the study, a Select Standing Steering Committee (SSSC) should be established to advise the executive agency and review progress on a regular basis. The group recommends close links with GEMS. As a first task, the SSSC will estimate the scope of the workload including sample size.

10. The task group underlined that existing knowledge is not sufficient to make a general recommendation covering the whole Mediterranean area that balances adequate public health protection against the benefits of unrestricted consumption of fish.

11. However, the Member States may wish to revise or establish regulatory actions at this time in view of the available knowledge (UNEP/MED-HG/6, 7 and 12).

12. The task group stressed the urgency of implementing phase I in order to obtain a better data base for regulatory action.

13. The following approaches would be used to assist populations identified as being highly exposed during phase I.

14. Control measures may be applied to the entire population or to select groups and this may influence the type of measures to be used. The following general approach is possible:

    (a) Setting standards limiting mercury concentration for all species used as seafood or for selected species of fish and edible marine organisms.

(b) Restrictions on fish size for certain fish species where mercury levels are known to be a function of fish size.

(c) Advice on dietary intake which include choice of species of fish and on other appropriate protein sources. The effectiveness of any control measures should be checked as part of the human hair level monitoring programme.

(d) In 'hotspots' - regions of locally elevated mercury concentrations of natural or anthropogenic origin - special control measures may be required. Preferably, these should include treatment or process technology when the origin is anthropogenic, leading to the elimination of discharges. In the meantime, it may be necessary to control or ban the eating of fish in such areas if intake is likely to lead to a methylmercury intake in excess of the WHO provisional tolerable weekly intake.

15. Phase II - Depending on the results of phase I, populations or groups may be identified having high exposure. In this case, phase II should be initiated. Phase II will quantify the hazard from methylmercury in order to give a basis for appropriate control measures. Phase II will involve the following steps:

(i) Human monitoring should be continued for hair levels of mercury and extended to the area for which the population is representative.

(ii) A careful assessment of dietary intake of methylmercury will be made in this population or group. This will include the patterns of individual consumption of fish, shellfish or fish commodities and determination of mercury levels if they are not available. However, it is expected that mercury levels will be available for edible fish based on current programmes. It is advisable to use a pilot project to check the reliability of techniques to determine patterns of individual fish consumption.

(iii) Recognizing that the course of the disease cannot be ameliorated by medical treatment, given the present state of our knowledge, the only effective control is by prevention achieved by lowering intake. Nevertheless, dependant on the availability of medical resources, medical examination including neurology, should be offered to the highly exposed individuals to assess clinical

effects and provide advice and interpretation. The decision on who should be examined should be based on the information contained in documents UNEP/MED-HG/11 and 12.

(iv) If circumstances allow, a carefully planned epidemiological study should be carried out in the Mediterranean area related to both adult and pre-natal exposures.