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GUIDING PRINCIPLES FOR MONITORING AND ASSESSMENT
OF DIETARY EXPOSURE TO HAZARDOUS SUBSTANCES

Report on a Consultation

Zadar, Yugoslavia
16-18 October 1990

Abstract

Current strategies for monitoring food and drinking-water contamination in Europe were reviewed in the light of experience with the food component of the Global Environment Monitoring System (GEMS/Food). It is recommended that a European programme to monitor contamination, based on GEMS/Food, be set up with the active participation of all Member States, who would need to adhere to strict guidelines. The Regional Office should investigate setting up collaborating centres to support the programme, call together national focal points to develop all aspects, and issue regular reports summarizing and assessing the data collected. It would also collaborate with other relevant international organizations. Member States are to monitor the programme and are encouraged to develop their own geographic information systems. They should also participate in other current monitoring projects such as HEAL, study populations at risk, and establish food specimen banks. Support should be provided for technical collaboration, especially with the countries of central and eastern Europe.

Index:

FOOD CONTAMINATION
DRINKING WATER
WATER POLLUTION
HAZARDOUS SUBSTANCES
ENVIRONMENTAL MONITORING - methods
EUR

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Introduction

Significant progress has been made in all European countries in introducing comprehensive standards for acceptable levels of hazardous chemicals in food, air and drinking-water. Particular efforts have been made to harmonize the implementation of environmental standards throughout the countries of the European Community.

Despite significant progress in developing health-related environmental standards, the steps taken to monitor and control environmental hazards, particularly with respect to chemical pollution, are in many cases inadequate. Monitoring and control strategies tend to be limited to single sources of exposure. They focus on a dozen chemicals from the list of "incriminated substances" without the possibility of assessing and controlling the dynamic developments in the environment concerning intentional or unintentional releases of toxic chemicals, their interactions, and the consequences for health and the environment. Different sectors are responsible for different areas, without the possibility of further integrating data obtained through overall exposure assessment and of assessing health consequences. This is to a great extent due to a lack of systematic collection and analysis of health-related environmental data, which would permit countries to develop comprehensive risk assessment and to set priorities, as well as to develop essential indicators of the effectiveness of preventive action (1).

It is recognized, however, that not everything that can be measured should be monitored, and that effective prevention depends primarily on the appropriate machinery for priority setting. The main prerequisite for making decisions with respect to priorities, resources and management is the availability of accurate and adequate health-related environmental data. Development of

appropriate information systems and databases through international collaborative efforts will significantly improve the national capacities for risk management decisions, for assessing trends, and for testing the efficiency of introduced control measures (2).

To assist governments of the European Region to develop, strengthen and improve programmes for the effective and efficient monitoring and assessment of dietary exposure to hazardous substances, a decision was made to explore the possibility of using the Global Environmental Monitoring Programme on Food Contaminants (GEMS/Food), with some additions, modifications and improvements, as a core programme for this purpose. To get advice following this important decision, the Regional Office had discussions with the governmental representatives responsible for food safety at an intergovernmental meeting organized by the Regional Office in Brussels in November 1989 (3). The participants at that meeting were informed about the GEMS/Food programme, underlining its aim of informing governments and other relevant institutions about the levels and trends of contaminants in food, their contribution to the total human exposure, and their significance with regard to public health. The participants expressed the view that the broad European programme on monitoring of contamination should be established based on full participation of all Member States, and with the additions and improvements to the GEMS/Food programme as may be required to meet the requirements and specific needs of European countries. It was recommended that the new programme should re-evaluate the list of contaminants and foods to be monitored so as to reflect Regional priorities. Moreover, the participating countries will need to adhere to strict requirements regarding sampling, methods of analysis, analytical quality and the consistent submission of data on agreed contaminants and foods. The

meeting felt that this could best be achieved by establishing a European analytical quality assurance scheme.

Following this recommendation, the Regional Office organized the present Consultation in collaboration with the Institute for Medical Research and Occupational Health in Zagreb, to review current strategies for monitoring food and drinking-water contamination in Europe in the light of experience gained in the GEMS/Food programme. Based on a comprehensive analysis of current practices and feasible options, the Consultation was asked to recommend the most appropriate approach to developing a European programme for monitoring and assessing exposure to hazardous substances through food and drinking-water. The Consultation was attended by nine experts, including representatives of the national GEMS/Food focal points, from eight countries, as well as one representative of the United Nations Environment Programme (UNEP), two staff of WHO headquarters and three staff of the Regional Office (Annex 1). Dr S.A. Slorach was elected Chairperson, and Dr M. Richardson Rapporteur.

Discussion and conclusions

Current international and national activities

After a short discussion on the concepts involved, brief presentations were made on GEMS/Food, the UNEP/WHO Human Exposure Assessment Location (HEAL) project, the Regional Office's Geographic Information System (GIS), and the UNEP Global Resource Information Data Base (GRID). Subsequently, current national food contamination monitoring activities in Denmark, Finland, Germany, the Netherlands, Poland, Sweden, the United Kingdom and Yugoslavia were briefly reviewed. It was noted that, in many countries, responsibility for monitoring food and drinking-water did not reside in the same ministry or agency.

GEMS/Food programme

The participants were informed of the activities and progress of the programme, which was launched in 1976 as a global programme with the initial participation of 13 countries. The programme is an important part of national and international efforts to assure a safe food supply, and it provides the basis (where appropriate) for remedial action, food control and resource management. It is not a compulsory WHO programme. Its main objective is to compile food contamination monitoring data on chemicals from the different countries to enable one to: establish a baseline and indicate trends in the levels of a food contaminant with time; give an indication of the effectiveness of measures introduced to reduce food contamination; and compare the levels of contaminants in food with established standards or guidelines. Nineteen contaminants are covered by the programme, including selected pesticides, industrial chemicals and naturally occurring toxins. The available data on pesticide residues in food cover eight of the organochlorine pesticides most prevalent in the environment, i.e. DDT, aldrin, dieldrin, and five organophosphorus pesticides including malathion and parathion. The industrial chemicals included in the GEMS/Food database are PCBs, lead, cadmium, mercury and tin. At present, aflatoxins are the only naturally occurring toxins covered by the programme.

By 1990, the number of participating countries in the programme had increased to 39, of which 11 are European. Guidelines prepared under the Joint FAO/WHO/UNEP GEMS/Food Contamination Monitoring Programme, which give general guidance to the participating countries, including those on establishing or strengthening national food contamination monitoring programmes, on studying dietary intakes of chemical contaminants, and on predicting dietary intake of pesticide residues.

Monitoring data collected so far were reviewed during an Expert Meeting held in Geneva in 1988, and for each topic an assessment was made on the global and regional levels and trends (4). The main results of this most recent assessment of chemical contamination of food in most of the countries of the European Region could be summarized as follows.

- The current median/mean levels of contaminants in individual foods and in total diet are generally well within established health criteria, guidelines or standards.
- The trend in contaminant levels in food is generally downward, as the use of persistent pesticides and other toxic chemicals is curtailed or banned altogether.
- There are situations where the general population may not be at risk but specific population groups may be unduly exposed. Considerable contamination of certain food has been reported, such as organochlorine pesticides and PCBs in human milk, mercury and PCBs in fish, lead in food in soldered cans, and aflatoxins in nuts and cereals.

In addition to studying the assessment report, the Expert Meeting reviewed the programme and made recommendations concerning ways in which the monitoring programmes and future activities could be improved. Disparity between countries in the numbers and types of foods and the list of contaminants that are monitored, as well as inadequate assurance of the quality of data, were identified as the main problems of the GEMS/Food programme.

Based on an analysis of shortcomings and problems encountered in the GEMS/Food programme during the last 14 years, the recent GEMS/Food review and planning

meeting held in Challes-lès-Eaux in July 1989 (5) revised the overall objectives of the programme and developed several recommendations and decisions covering the following subject areas:

- selection of contaminants and foods
- reporting and data handling
- analytical quality assurance
- technical cooperation, and
- management/coordination.

The following is the text of the new revised objective of the GEMS/Food programme.

"The major objective of the programme is to inform governments, the Codex Alimentarius Commission, other relevant institutions and the public on levels and trends of contaminants in food,^a their contribution to the total human exposure and significance with regard to public health. This is to be done globally, regionally and locally, as well as in geographical areas of special concern, as a basis - where appropriate - for remedial actions, for food control and for resource management. Components supporting the programme involve technical cooperation, analytical quality assurance programmes and information exchange."

^a At present these refer to chemical contaminants only. The addition of selected microbiological contaminants is being considered, as is the inclusion of drinking-water.

Human Exposure Assessment Location (HEAL)

Traditionally, pollution monitoring has been concerned primarily with the source of the pollutants and their movement through the environment. This source-oriented monitoring provided little information on the exposure of individuals to pollutants. To improve knowledge about total exposure to certain environmental pollutants through several routes of exposure, WHO/UNEP developed the HEAL project as part of the health-related component of UNEP's Global Environment Monitoring System (GEMS).

The HEAL project has four specific objectives:

- to provide comparable assessments of human exposures to environmental pollutants around the world and to identify trends;
- to improve, test, coordinate and demonstrate methods for human exposure monitoring;
- to promote human exposure assessment as a basis for environmental control strategies to protect human health; and
- to improve national exposure monitoring capabilities, especially in developing countries.

The HEAL project consists of two parts: collaborative field studies and supporting activities. In the collaborative field studies, participating countries jointly study human exposures to selected pollutants, using agreed standard procedures and quality control measures. These collaborative field studies produce new data on human exposure in different parts of the world. The countries and the UNEP/WHO secretariat jointly decide which pollutants to study. Countries normally participate only in those investigations of high national priority.

The supporting activities complement the field studies and help all countries improve their human exposure monitoring and assessment programmes (6).

Geographic Information System (GIS)

The Regional Office is developing a programme on a Geographic Information System (GIS) related to environment and health and based on national activities coordinated by the WHO collaborating centre in Bilthoven and the Bilthoven office of the European Centre for Environment and Health. This programme will provide for the collection of geographically related environment and health data, and is intended to produce thematic maps of the local "state of environment and health" throughout the Region at scales appropriate to the issues of interest. A GIS may be useful in mapping potential sources of food contamination from naturally and anthropogenically occurring soil and water constituents. Also, it was concluded that a GIS may be useful to map food consumption and food contamination on a seasonal, national, regional or local basis as appropriate (7).

European programme on monitoring and assessing dietary exposure to hazardous substances

Objectives

The European programme on monitoring and assessing dietary exposure to hazardous substances is based on GEMS/Food. The Consultation agreed that the general objectives of the GEMS/Food global programme were also appropriate for the above-mentioned European programme, but the latter should reflect much more the actual needs of the countries of the Region. Drinking-water would be included, as this may be an important source of ingested hazardous substances. Additionally, veterinary drug residues and radionuclides should be included, but medicinals, microbiological contamination, intentional food additives and dietary supplements should be excluded.

In addition to the revised GEMS/Food programme objectives (see p. 4) and the objectives defined above, the Consultation agreed that the European programme should be further developed by:

- encouraging all Member States in the European Region to participate actively in the programme, this goal to be achieved if possible by 1995;
- revising the list of hazardous substances and foods to reflect more closely the needs of European countries;
- including the intake of hazardous substances via drinking-water in the total dietary intake;
- improving the quality of dietary and analytical data collected;
- improving data management as regards the collection of data from participating countries, its timely evaluation and dissemination; and
- providing food data for the GIS.

Main benefits

The potential benefits to be derived from the European programme may be summarized as follows:

- systematic collection and integration of health and related environmental monitoring data relevant to food and drinking-water, allowing development of comprehensive exposure and risk assessments;
- an improved database for setting priorities and developing essential indicators to measure the effectiveness of preventive actions;
- improved safety of foods and drinking-water;

- warning of actual and potential food contamination problems, both local and international;
- provision of data on the intake of contaminants via food that contribute to toxicological evaluations of possible human health hazards and to epidemiological studies;
- improved economic prospects, especially for some of the developing countries, through better management and optimal utilization of natural resources, and improved returns from the export of quality controlled food and drinking-water;
- continuing information on levels of environmental pollution throughout the European Region, hence providing data that can contribute to an eventual reduction in pollution and to the overall improvement of the human environment, as well as to a much greater control of discharges of hazardous substances;
- provision of reliable information to the public on the safety of foods and drinking-water; and
- provision of a means of checking the effectiveness of established regulatory mechanisms and a means of planning suitable technological developments.

Sampling and analysis

The Consultation paid special attention to questions of sampling and analysis, since the inconsistent use of techniques could be a source of inaccuracy and non-comparability of data. Countries should therefore be encouraged to follow the GEMS/Food guidelines (8). The Consultation also emphasized that samples should be representative of the specific hazardous substances to be monitored and the commodity to be involved. The number

of samples to be analysed will depend on the statistical uncertainty accepted. Integrity of samples should be recognized at all times (8).

According to the 1985 guidelines (8) there are no standard analytical methods for dietary intake studies; any available method may be used provided that it is capable of producing reliable data at the required level of sensitivity. National or international recommended methods can serve for reference. Each method should be validated with respect to sensitivity, specificity, accuracy, robustness, linearity, precision and blank values (8).

Analytical quality assurance

The Consultation noted the results of the current analytical quality assurance programme based on the GEMS/Food guidelines concerning quality assurance procedures (8). Although faced with many difficulties, the results of the current GEMS/Food quality assurance programme for selected organic and metal contaminants are encouraging, since this programme can contribute directly to an increase in quality of national food laboratories. Some specific points were discussed by the Consultation, and it was concluded that internal quality assurance by the use of reference materials is of great importance; that external quality assurance can be obtained by collaborative studies; and that continued accreditation of professionals could be important for analytical quality. Unfortunately, for many of the analytes of interest no adequate reference material exists. Producers of these materials should be encouraged to develop reference material for dietary intake studies.

The latest recommendations developed by the GEMS/Food review and planning meeting (5) related to the improvement of the analytical quality assurance programme, and were discussed in extenso. It was agreed that, from the point of view of feasibility and

acceptance by the participating countries, these questions should be discussed in more detail at the larger consultation in 1991.

Food consumption data

Although many countries have data on food consumption in the form of statistics on food disappearance (9), few have adequate information on the intake of foods, including drinking-water, by individuals or specific population groups. To provide a better basis for nutritional and toxicological assessment of foods and diets, governments should be encouraged to carry out more appropriate food consumption surveys according to the GEMS/Food guidelines (8).

The European Conference on Food and Nutritional Policies, held in Budapest in 1990 (10), endorsed the above-mentioned proposals. It requested WHO, FAO and other international and national agencies to study the feasibility and cost of creating reliable and accessible European sources of information, including better and more comparable data on health, nutritional status, food composition and food intake.

Food specimen banks

The Consultation also discussed the possibility of initiating an international programme on food specimen banks. It was recognized that specified representative food and diet samples stored in such banks can be used to study time-trends in the levels of hazardous substances in foods and diets. Samples of staple foods are of particular value. As analytical methodology evolves, it may become possible to determine certain contaminants in individual foodstuffs and diets.

Samples should be chosen in such a way that they are representative of the foodstuff or diet in the whole of the country, or in specific regions. The way in which

the samples are selected, prepared and stored should be documented. Samples should be collected at regular intervals.

Recommendations

1. In close collaboration with the GEMS/Food programme, the WHO Regional Office for Europe should establish a European programme on monitoring and assessing dietary exposure to hazardous substances.
2. The Regional Office should inform all Member States of the need for and benefits of the European programme and encourage them to participate actively, if possible by 1995.
3. Participating countries will need to adhere to strict requirements regarding sampling, methods of analysis, analytical quality, and submission of data on agreed contaminants and foods according to the GEMS/Food guidelines.
4. The Regional Office should investigate the feasibility of establishing one or more collaborating centres to support the implementation and coordination of the programme, as well as to help in the analysis of food, drinking-water and diet samples from countries lacking relevant facilities for specific chemical analysis.
5. The Regional Office should organize a meeting in 1991 of nationally nominated focal points to develop all aspects of the programme, including:
 - selection of hazardous substances and foods to be included in the programme;

- agreement on sampling plans appropriate to the purpose of the monitoring studies, and on procedures to maintain the integrity of the samples;
 - initiation of an analytical quality assurance programme, with agreement on key technical questions based on established guidelines;
 - agreement on the technical implementation of food consumption surveys based on the GEMS/Food guidelines so as to provide an improved basis for determining the dietary intake of hazardous substances, nutrients, etc.; and
 - agreement on data management at national and international levels.
6. The Regional Office should issue regular (if possible annual) reports containing a summary and assessment of the monitoring data collected.
7. Member States should review the progress of the programme at least every five years, and revise it if and when necessary.
8. Support should be provided for technical collaboration, especially to the countries of central and eastern Europe, continuing the current efforts to attract extrabudgetary resources for this purpose. This collaboration should focus on expert guidance in the planning, implementation and evaluation of monitoring programmes; training; and strengthening of national institutions and infrastructures.
9. Member States should be encouraged to develop national GIS with appropriate quantification of data, so that food consumption and food and drinking-water contamination (from natural and anthropogenic sources) and their local variations can be evaluated.

10. Member States should be encouraged to participate in the GEMS and HEAL programmes, so as to evaluate the contribution of dietary intake to the total exposure of target populations and, where appropriate, to assess the accuracy and validity of their estimates of dietary intake of hazardous substances.

11. Governments should be encouraged to identify and study selected populations that may be at risk due, for example, to their high intake of specific hazardous substances.

12. Member States should be encouraged to establish banks of representative samples of staple foods, drinking-water, market samples and duplicate diets for future analysis for hazardous substances, nutrients, etc.

13. The Regional Office should collaborate with other international and regional organizations working in this field, e.g. FAO, UNEP, IAEA and the European Community, to avoid duplication of effort.

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Annex 1

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