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**P**ANEL OF  
**E**XPERTS ON  
**E**NVIRONMENTAL  
**M**ANAGEMENT FOR VECTOR CONTROL  
**(PEEM)**

Report of the First Meeting  
WHO, Geneva, 22 - 29 September 1981



PEEM Secretariat  
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Geneva, 1981

REPORT OF THE FIRST MEETING OF THE JOINT WHO/FAO/UNEP PANEL OF EXPERTS  
ON ENVIRONMENTAL MANAGEMENT FOR VECTOR CONTROL

Geneva, 22-29 September 1981

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The WHO/FAO/UNEP Panel of Experts met in Geneva from 22 to 29 September 1981. Dr N. G. Gratz, Director, Vector Biology and Control, in introducing Dr J. Hamon, WHO Assistant Director-General, and welcoming the participants, pointed to the great importance the participating organizations attached to the joint Panel of Experts and to the outcome of the meeting. One expected result would be the planning of action programmes to implement the recommendations and decisions proposed by the Panel for the improvement of the health and environmental aspects of water resources development projects.

Dr Hamon opened the meeting on behalf of the Director-General of the World Health Organization, the Director-General of the Food and Agricultural Organization and the Executive Director of the United Nations Environment Programme. Dr Hamon pointed out that this meeting was perhaps long overdue. The importance of the health aspects of water resources development projects and the serious consequences of their being given inadequate consideration could not be overemphasized. A review of the irrigation schemes and water impoundments in the developing world showed that, perhaps with a few exceptions, their development had coincided with a deterioration of the health of the population living and working on the schemes. The expanses of water they created led to a multiplication of vectors and hence an intensification of disease. The result was an increasing number of ill and unproductive farmers and a decline in economic and social development. In view of the great dependence of the developing world for food, fibre and energy production on the development of their water resources and on agricultural extension, this Panel already had a vital role in seeking an approach to a world-wide solution. This approach must lie in an effective intersectoral collaboration at national, regional and global levels and the solution in an early warning system and in the incorporation of health and environmental safeguards at the earliest stages of projects' development and planning.

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## 1. Introduction

In the past little or no consideration has been given to the health and environmental aspects of water resources development and exploitation. Although methodologies for prevention and control of undesirable health effects existed, the institutional framework for their consideration and incorporation was inadequate or inexistent. Collaborative mechanisms to bring together the various concerned disciplines and agencies were yet to be organized.

The joint WHO/FAO/UNEP Panel of Experts has been established according to the Arrangements agreed upon by the three participating organizations to create the kind of institutional framework that has been lacking.

Prior to the establishment of the Panel the health aspects of some water resources development projects had been considered in WHO/FAO project review meetings. In February 1973, the eleventh and the last review meeting was held in Rome. In 1978 a Memorandum of Understanding was signed by WHO and FAO, and later in 1981 by UNEP. The Memorandum provided for institutional collaboration among United Nations agencies involved in the development of water resources. The Arrangements subsequently concluded between the three organizations provided for the formation of this Panel in May 1981.

## 2. Terms of Reference and Functions

The Panel and the agenda of its first meeting are built around three major premises.

(1) Water and other natural resources development projects, particularly in tropical developing countries, have frequently led to adverse effects on the health of those living and working in the project area, and almost invariably have contributed less to health improvement than they should have been required to do.

(2) Much is known about how to prevent adverse health effects of water resource development, but this knowledge could be extended and in any case is not widely applied due mainly to a lack of an institutional framework for effective intersectoral collaboration.

(3) The time is ripe, if not overdue, for a determined effort to set up national, regional and global organizations to implement possible improvements.

The terms of reference of the Panel of Experts as previously laid down and as amended by the Panel are as follows:

(1) The Panel of Experts will:

(a) promote the setting up of an institutional framework for effective collaboration among organizations and agencies at national, regional and international levels responsible for or dealing with natural resources development;

(b) review the status and progress of environmental management activities within health programmes and in programmes and projects for the development of natural resources and agriculture, with particular reference to water development projects;

(c) advise on means of promoting measures for the protection of human health through the application of environmental management for disease vector control in the planning, design, construction and operation of projects for the development of land, water and other natural resources;

- (d) advise on ways of securing continued technical and financial support at national and international levels and on areas where research or field investigations are required, and propose related projects as well as the sites where the latter can be carried out;
- (e) suggest guidelines for the identification and formulation of health protection measures in water resources development and for the introduction of necessary provisions in project planning, design, construction, operation and maintenance;
- (f) review the status of skilled manpower resources and training facilities for environmental management activities in vector control, and advise on and encourage necessary improvements by such measures as the establishment of training courses, seminars and workshops and the preparation of manuals;
- (g) advise on the collection and dissemination of information on research, progress and innovations in techniques for vector control, including investigations into the feasibility of establishing an international reference centre;
- (h) periodically study the status of interagency coordination and give advice on ways of collaboration at national, regional and global level;
- (i) give advice on any other matters relevant to the strategies and activities to be carried out in the context of the objectives set out in Section I of the Arrangements.

(2) At the beginning of each year, the Panel of Experts will propose, for the consideration and approval of the participating organizations, its plan of work for the year concerned.

(3) The executive head of any of the participating organizations may request the advice of the Panel of Experts, or of individual members, on matters coming within its competence.

(4) The Panel of Experts will periodically review its own functions and performance and propose to the participating organizations any necessary changes to enhance its effectiveness.

The major aim of the Panel is to bring together various organizations and institutions that are involved in land and water development at national and international levels, to create a forum for communication and exchanges of views and to ensure that everyone concerned is informed and conscious of the possible consequences of such development and receives adequate advice and guidance in time.

To accomplish this task the Panel will include all disciplines concerned and involved in development affecting land and water resources whether technical, managerial or sociocultural and political, from national, international, private and governmental agencies.

The Panel will identify and establish close communication lines with organizations and firms at national and international levels assisting or planning or constructing development works. It will collect and disseminate technical information to keep these organizations and firms, as well as individual professionals concerned, abreast of latest technical developments for protection of health and environment. For this, it will encourage field research and establish close ties with scientific institutions. Where necessary, field research projects will be formulated by the Panel and assistance will be sought and secured for their financing and implementation and for dissemination and application of results achieved.

The Panel will produce guidelines, manuals and technical publications and organize courses and seminars for the training of national and international specialists in techniques and methodologies of applying health and environmental safeguards.

The Panel will promote integrated development strategies and discourage narrow sectoral and compartmental practices.

The Panel will stimulate and encourage the establishment of similar panels at national and regional levels and maintain communication with and support to this network.

### 3. Health and Environmental Implications of Water Resource Development Projects

#### 3.1 Basic statement

In the last two to three decades, development and exploitation of natural resources has reached an unprecedented dimension especially in developing countries. The increasing demand for water, food and fibre production and for energy and raw material for industrial extension has led to the launching of a great number of development projects of different sizes in various parts of the world. Many of these projects, especially those related to land and water development in the tropics, involve important environmental and health changes, some of which are undesirable.

The impact of water resources development projects on health may be intentional and beneficial as with most domestic water supply and sanitation schemes, or it may be unintentional and possibly adverse as has been the case with many hydroelectric power and irrigation projects. In view of the large amount of literature and case study documentation in this area it cannot be truthfully said nowadays that the adverse consequences to health of such development projects are totally unexpected; unless deliberate measures to avert these consequences are taken at planning, design and operation and maintenance stages, then health problems will occur. This much is clear from past experience, even if it is also clear that the prediction in detail of the effects of environmental change on disease and disease vectors is not simple.

Experience shows that many agricultural schemes, especially in developing countries, are afflicted with high prevalence of diseases that could have been prevented, usually with some extra effort, were certain health and environmental safeguards observed in their planning and in the construction works. For many of these projects a restoration of healthy environment may take considerable time and effort and important resources. Failing that, continued degradation of health and environmental quality may largely defeat the very purpose of the project's development and lead to the further decline of the socioeconomic conditions of the population involved.

Over 350 dams with a height of 15 metres or more are completed each year adding to the inventory of 10 000-12 000. It was estimated in 1977 that by 1985 some 23 million hectares of irrigated land would be added to the 50 million which existed at that time. Considering that in Africa alone only 22% of the arable land is cultivated, one can imagine pessimistically but perhaps realistically the vast magnitude of health and environmental problems which lie ahead.

#### 3.1.1 Important facets of land and water development

The Panel reviewed the nature of the adverse health effects that may result from the construction of dams, irrigation development and resettlement.

The impoundment of water by the construction of a dam usually constitutes a very significant and sudden change in the surrounding physical environment. The resulting changes in the biological environment can have very important implications for human health. Because many of those responsible for planning and design of dams have little or no understanding of the ecological and biological implications of the changes they make to the physical environment, such development projects can have untoward and unforeseen consequences.

In many dam projects, while the natural fast water larval habitats of the onchocerciasis-transmitting Simulium fly have been submerged and destroyed, the possibilities for the survival and breeding of anopheline and other mosquitos, and schistosome bearing snails around the newly formed lake have been significantly increased.



The development of agricultural land through irrigation involves environmental changes which affect the disease vector ecology. The observed result is generally to reduce the diversity of vector breeding sites, but to vastly increase their available number. Open canals, drainage ditches, borrow pits and seepage areas of standing or slowly flowing water provide favourable habitats for mosquitos and snails in particular. The problem is exacerbated by poor maintenance of canals and ditches, with weed growth slowing down the water flow and thereby producing suitable breeding places for disease vectors.

Dam projects and irrigation schemes both involve resettlement of rural communities, and usually an influx of labour force. If resettlement is not carefully planned and monitored as part of the development project human health problems are almost sure to occur or to be aggravated. Two important aspects of resettlement in the present context are the location of communities and the water supply and sanitation facilities available to them. Other aspects include medical screening of the labour force and its protection against the local health hazards.

Communities need to be sited some distance from open water to reduce contact with the disease vectors or schistosome infested water. This is only possible if safe and adequate supplies of water for drinking, bathing and washing, as well as drainage and sanitation are provided. In the past, communities have not been adequately protected in these respects.

### 3.1.2 The diseases

Although more than 37 diseases or groups of diseases that are water related were referred to in its discussions, the Panel gave its attention to the more important vector-borne diseases: malaria, schistosomiasis and filariasis including onchocerciasis, as well as to water-borne diarrhoeal diseases.

## 3.2 Discussion of issues

### 3.2.1 General issues

The Panel considered several issues of a general nature that will need increasing attention. The first was a sense of realism. Several environmental management measures are crucial in limiting the spread of disease and can be implemented at low cost, especially if incorporated in the general design of the systems and carried out together with the construction of the works. However, some may be immensely costly if they are introduced separately, and may then distort the pattern of expenditure on health. Environmental management measures and health care improvements are usually complementary and may jointly constitute strategies to reduce the burden of disease.

Concerning the financing of reserves for the health protection component of projects, attention was drawn to the possible high costs of certain specific measures in relation to the overall costs for national health protection. It was pointed out, however, that some schemes in which heavy investment had been made, but without provision for health protection had subsequently been abandoned because of the unacceptable health hazards that had resulted.

It is therefore fully justified, and indeed essential, to provide funding for a study of health protection within the benefit/cost analysis for individual schemes although this may represent a very high per capita cost relative to regional or national expenditure on health.

In examining a water development project, not only the possible adverse consequences for health but also the opportunities for improving health should be considered. One should go beyond environmental impact statements to what might be called "health opportunity assessment". This may help to adjust the priorities accorded to various measures being proposed. The assessment should focus on the populations involved, as the intermediary between environment and health or disease rather than just on the environment. There will be hazards arising directly from the development and a need for both design modifications and complementary inputs if such hazards are to be minimized. There are also opportunities to improve health both by the design of the development and by the provision of essential health care facilities.

For example, when a project requires people to relocate their homes, there is an opportunity to ensure the provision of a proper health care service, water supplies for domestic use and sanitation facilities, regardless of any other health or disease implications of the project.

The purpose of such a health opportunity assessment is to guide and assist rational planning by systematically examining all the above-mentioned issues.

The Panel noted that there were a very large number of small-scale water development projects which, however, in total involved very large human populations. The large dam and vast irrigation projects under central control are in many ways more tractable since major financing institutions are more likely to insist on assessment and prevention of health hazards, and special authorities of a superdepartmental type can be set up to implement large projects - the Tennessee Valley Authority and Volta River Authority are examples. By contrast, small-scale water developments must depend on the local health services and local engineering expertise for disease control measures.

It should also be remembered that many places with traditional agricultural systems, including the rice growing areas of South-East Asia, already have water associated disease problems in the form of ricefield-breeding vectors of malaria, schistosomiasis, filariasis and Japanese encephalitis. These problems should also receive attention in environmental management plans for vector control.

When one strong agency dominates a development scheme, the opportunities for unilateral decision-making often militate against intersectoral collaboration for the implementation of measures for health and environmental protection.

At the other extreme, regional development programmes with the generalized goal of improving the socioeconomic conditions of the inhabitants, and involving multiple specialized departments and agencies, may be more favourable to health improvement since intersectoral cooperation is essential for any progress to be made in such programmes. In theory, the balance of multiple competing interests will lead to a plan which approaches the optimal. Furthermore, these various agencies may focus their cooperative effort on water since it is a common concern of all whether dealing with health, agriculture, fishing, hydropower or flood control.

The Panel's discussions tended to centre on water resources development schemes and their dangers to health and the environment. It was pointed out that this was a narrower concept than was intended in the Panel's terms of reference. Many developments and schemes that cannot be classified primarily as water developments can also affect the prevalence and spread of vector-borne diseases. Examples are the opening up of land for agriculture in tsetse infested or tick infested areas, or in zones threatened by onchocerciasis. These can more appropriately be classified as land development schemes, although water forms an essential component in them. The studies and actions of the Panel should therefore extend beyond the limited area of water development, and into the associated settlement, production and management issues of land and water development and use involving risks to health from vector-borne diseases.

A number of references were made to animal health. As the subject is already well covered elsewhere, it was agreed that the Panel should take account of this aspect only in so far as it is relevant to human health, or is related through common vectors, or where protection measures can give general socioeconomic benefits.

Attention was drawn to the limitations of presently applicable knowledge. While it is urgent to apply what is known, there is also much room for further research especially on appropriate technologies to solve the many remaining problems.

The Panel members repeatedly, and in varied contexts, drew attention to the necessity of focusing on national institutions for much of what was proposed and to the need for multi-disciplinary team work.

### 3.2.2 Epidemiological and environmental issues

The effects of water and land resource development projects on disease vectors are extremely complex. These projects involve severe ecological alterations of existing fauna and flora, many of which are not easy to forecast. Also the long-term effects are often different from the short-term ones. For example, density of Anopheles larvae increased shortly after construction of the Kujbishev reservoir in the USSR as a result of the invasion of deep water aquatic vegetation but decreased 3 to 4 years later as these plants died. Ten years later new types of vegetation had developed around the perimeter and an excellent correlation between larval density and the water level in the reservoir was observed.<sup>1</sup>

The effect of reservoir projects on vector densities also depends upon the climate and degree of pre-impoundment preparation as well as post impoundment management including the seasonal pattern of water level fluctuations resulting from normal reservoir operations. Most important are those portions of the shoreline where people live or frequent for work or other reasons. The health consequences much depend upon the existence or absence of vector species in the project area and the prevalence of the diseases in the human population. Despite these complexities, the pattern of diseases anticipated from water resources development can be reasonably well predicted. Both pre- and post-construction surveys and studies on the vectors and the diseases are vital for resolving the health and environmental issues of water development projects.

In water resource development projects it is essential to avoid situations where the expected benefits are outweighed by the consequences of the health hazards accruing. Although much of this kind of environmental deterioration can be corrected thereafter if funds are available and proper measures are instituted, the cost may be so great as to render such effects irreversible. This underlines the need for adequate health opportunity and environmental impact assessment and the incorporation of adequate safeguards in the design of dams, impoundments, land reclamation and irrigation schemes. In the planning of such projects, sociologists, anthropologists, epidemiologists, ecologists and environmental scientists must participate in assessing the possible health and environmental effects. The participation of the community is also vital because development projects will usually affect established life styles and customs.

Where several vector-borne diseases occur in one particular development project, the specific ecology and epidemiology of each requires detailed consideration in order to ensure that measures designed to reduce one particular disease vector do not favour the intensification of another. On the contrary, such measures should help suppress other vectors following the principles and practices of the comprehensive and integrated approach. For example, in attempts to combat or discourage the breeding of snail intermediate hosts of schistosomiasis by raising stream flow velocities, and installing dam spillways, it becomes essential to avoid the creation of suitable habitats for the larvae of the Simulium damnosum complex, vectors of onchocerciasis.

### 3.2.3 Socioeconomic issues

The Panel noted that four factors, namely population growth, scarcity of food, desert conditions and power requirements, had led to the construction of an increasing number of dams, man-made lakes, irrigation and drainage schemes and land reclamation projects to increase agricultural production and to generate power. In the development of these projects a whole inventory was prepared in order to estimate the costs involved and the benefits expected. The Panel stressed the need to prepare also an inventory of possible adverse effects, including vector-borne diseases and other possible health and environmental hazards. Such an inventory should, as far as it is feasible, be quantified in terms of the costs of minimizing the effects on public health. These costs should receive as much priority as the costs of other sectors of the project, e.g. construction of dams, canal systems, etc. The budget, to be complete, must also contain measures for the protection and promotion of public health, as part and parcel of the overall construction and management plan of the project.

The concept of integrated rural development has now become accepted in many countries. Integrated rural development programming offers an ideal opportunity to incorporate the prevention or control of vector-borne diseases in the execution of such programmes. Here again

<sup>1</sup> Semukina, T.V. & Ejova, A.D. (1973), *Med. parasitologia and trop. Coljezni*, N5, 592-597.

finance for the prevention and control of these diseases should be part of the financial package for promoting rural development.

In the discussion of socioeconomic issues, the point was made that, where administrative structures were poorly developed and planning ministries weak in exercising their coordinating roles, project financing often did not have balanced or proportionate allocations at the time of formulation. It was often conceived piecemeal and later the ministries concerned, including the health ministry, were left to find additional funds to cover their sectoral activities.

Funding agencies have, potentially, a strong influence on the protection of health in the projects they finance. As much development of water resources is funded from outside the country implementing the development, the requirement of appropriate health protection criteria as a condition of project approval offers a powerful means of improving the present situation.

The Panel noted with considerable interest that financial aid agencies and lending institutions were becoming increasingly aware of the need to consider the health and environmental impacts of development projects. The International Bank for Reconstruction and Development (IBRD), for example, had adopted policies of not only avoiding activity which would cause a deterioration in the world's environment but also doing what it could to improve environmental conditions where they had already been degraded.

The Panel recommended strongly that its participating organizations should put a lot of effort into inducing the financial aid agencies and lending institutions to include, in their terms of project financing, provisions for the protection and promotion of public health. Particular emphasis should be laid on combating the vector-borne diseases, which were associated directly with the construction and management of development projects. The effort to prevent their infecting mankind must therefore become part and parcel of socioeconomic development programming.

The Panel noted, however, that funds spent on preventing the adverse effects arising from development projects had been minimal in most cases. Special efforts were needed to give this matter much higher priority. Often limitations in development financing had been referred to as the main cause of the low priority now prevailing. The Panel felt that, while this might be one of the causes, a more important one was an insufficient recognition and appreciation of the impact of adverse health and environmental conditions. Planners and economists too often failed to understand the likely production losses due to poor health. The methodology of measuring losses in economic terms should be further developed and more widely applied and understood.

#### 4. Prevention of Adverse Impacts and Improvement of Health and Environment

The adverse health and environmental effects of water resources development projects usually originate from two major sources:

- (a) the modification of the local environment, and
- (b) demographic and socioeconomic changes.

In the first category the physical changes introduced in the local environment through the construction and operation of water reservoirs, impoundments and irrigation and drainage systems lead to the modification of plant and animal life. An existing forest gallery may be submerged under the reservoir and cause dislocation or elimination of wildlife. Sizeable areas of agricultural land may be lost under water in certain situations or sites of historical or traditional importance inundated. The vast expanses of water created may affect the local climate and increase the air humidity. They may also provide for a rapid propagation and increase in the population of vectors and intermediate hosts of a number of important water-associated diseases and thus an intensification of the diseases they transmit.

Certain changes are immediate and occur with the construction; these can be foreseen with an adequate degree of accuracy. Others emerge with the operation of the systems and may continue for several years; These are more difficult to predict.

In the second category are the considerable demographic changes that occur at the start of the project, usually even before construction begins. The area to be inundated by the reservoir needs to be evacuated of its resident population. A labour force is brought in from the neighbouring communities, and often also from distant centres, for the construction works. The newcomers may introduce new diseases into the area or contract the diseases that are endemic at the project site. Finally, when the construction works are completed and the project is to begin operation, new settlers will almost always move in and need to be screened for disease or protected from diseases endemic in the area.

In all of these population movements the health risks are considerable and the socioeconomic impacts may be serious for the displaced families and communities. While the economic impact may be generally favourable as a better income is usually secured, the social outcome is often disappointing due to the difficulties experienced by families and communities of different creeds and ethnic groups and from different areas and conditions when they have to live together and adjust to conditions in the working or settled areas.

A review of the existing and operating irrigation and impoundment projects in developing countries shows that whenever they are located in areas where water-associated diseases are prevalent, without exception they are plagued with an intense transmission of these diseases. What usually happens is that the residual foci with low transmission of the diseases that previously existed become gradually more widespread with intense transmission as the project is completed and goes into operation. Sometimes new diseases are introduced into the project area with imported labour and settlers. In these cases, usually the vectors and intermediate hosts already exist in the area and the new environmental conditions allow their rapid development and wide distribution.

In most of the projects reviewed control efforts were installed soon after the prevalence of the diseases became serious. However, in nearly all of them the positive effects have been limited and the prevalence of disease is still high.

Few of the older projects had a health or an environmental impact study. Any health surveys that were carried out were only to determine the endemicity levels and seldom did they lead to any preventive measures being incorporated in the project plans or to any substantial provisions for control. Such control measures as were applied consisted of limited treatment of infected cases and, in certain projects, some vector control usually by means of chemicals. However, feasible and effective preventive environmental management measures are available and if incorporated in the design and construction and in the operation of the systems, they could considerably reduce the need for subsequent control measures.

The Panel reviewed a list of environmental management measures available for application to impoundments and irrigation and drainage systems (WHO Technical Report Series No. 649), as well as a check list of major steps for the prevention and control of water-associated diseases in water resources development projects. It was agreed that these measures could be built into the design and carried out as part of the construction and operation of the systems. In that case they would cost considerably less; hence the need for their consideration in the early stages of the project planning. If applied subsequently, some of the more complex methods might cost considerably more, or become practicable only when the schemes had to be rehabilitated and modernized. The simpler environmental management measures, however, could be combined with other methods of vector and disease control, e.g., treatment of cases or chemical and biological methods, and applied even in the operating projects to control the prevalent diseases.

#### 4.1 Basic principles and procedures

The Panel noted with concern that adverse health and environmental impacts are still present in a great many water resources development projects and represent serious health and socioeconomic problems. There is a need to develop and apply approaches and strategies at both global and national levels to enable the available preventive and control measures to be applied to projects being planned and to those already in operation. It was the consensus of the Panel that, to be effective and feasible, these strategies and activities should be

nationally oriented and carried out by nationals. They should be modest and applied in phases and should be adaptable to varying local conditions in different countries. Collaboration at regional level through the institutions already existing would be very helpful and in most cases essential.

After a detailed examination of the procedural steps that should be taken and the framework required for their implementation, the Panel recommended the following:

#### 4.1.1 At the project level

##### 4.1.1.1 Health and environmental impact studies

Such studies need to be completed in respect of every project involving the development of water resources. They should constitute an essential component of the project and be initiated with the project's prefeasibility studies and continue into feasibility assessment. They should include a survey of the health and environmental situation in the project area, as well as in the neighbouring areas, and an appraisal of existing health and environmental problems and of potential effects that may be created as a result of the construction and operation of the systems. Both positive and negative effects should be appraised. Technical as well as socioeconomic and politicocultural aspects need to be considered to form the basis for planning the prevention and control strategies and for identification of activities, institutions and resources required for their implementation.

The studies should include collection of basic data and indices to enable monitoring of changes occurring and to allow evaluation of progress once the strategies are being implemented. This should cover indicators on health and environment as well as on socioeconomic and cultural aspects of the project.

##### 4.1.1.2 Incorporation of a health and environment component

To carry out the impact studies and to ensure that these aspects of the project receive adequate attention and are followed up, it is essential that a health and environment component should be planned and incorporated in the project's structure from the start. This component should be manned with competent and qualified staff in the related fields of epidemiology, environmental science, parasitology, biology and sanitary engineering, and also in those of sociology, economics, botany, etc. if not already represented in the project's overall staffing.

The health and environment component may use temporary personnel during the initial surveys and impact studies. However, as soon as the health and environment situation is assessed and if any adverse effects are predicted, permanent staff should be assigned to ensure sustained monitoring of the changes, the timely application of preventive and control strategies, and the adaptation of control strategies to meet changing situations.

The health and environment component should be established at the highest planning and directing level and given the necessary authority and prerogatives to enable effective operation and coordination with other sectors of the project.

The above provisions are normally recommended for large-scale projects. For smaller ones, a somewhat simplified approach may be adequate.

##### 4.1.1.3 Adequate financing

Adequate financing is the key question. Sufficient funds should be earmarked from the capital investment as well as from the project's income and operational budget, for health and environmental protection. The capital funds for the prefeasibility and feasibility studies should provide for the initial surveys and impact studies. Thereafter, the project's capital funds should provide for the preventive health and environmental safeguards that are to be incorporated into the overall design and construction works. As many of the measures have considerable immediate and long-term benefits to other sectors of the schemes, e.g. irrigation, agriculture, tourism, etc., the financing and distribution of costs should take account of these, and they should figure in the financing plan.

The project's operational budget should provide for the application of control measures, supervision of the maintenance works of the vector control and public health structures and epidemiological and environmental monitoring and evaluations. The control measures and requirements will include diagnostic and treatment services, drugs and pesticides, as well as personnel, equipment, supply and transport for their application, supervision and evaluation. The control measures also include the provision of safe, convenient and adequate water supply, general sanitation, health education and community participation, as well as a limited amount of field research. The personnel costs should also include training costs.

#### 4.1.2 At the national level

##### 4.1.2.1 Intersectoral collaboration

Development of water resources has, in the past, been the exclusive concern of one or two departments, usually the water and power and sometimes also the agriculture departments. The health and other related sectors have seldom been consulted and even less frequently invited to participate in the planning and operation of the scheme. Thus, collaboration mechanisms are lacking in most developing countries and, given the importance that health and environmental impacts have now attained, should be established in the form of national coordination boards, preferably at interministerial level. Such boards should include representatives from the concerned ministries, e.g., health, environment, water and irrigation, agriculture, finance, etc., and perhaps also from the related public and private scientific institutions and associations. They should be able to call on other departments and scientific institutions and to invite them to participate in board meetings and advise on technical and scientific fields on an ad hoc basis as required.

The National Coordination Board should be established by government decree and through legislative acts, and be provided with power to intervene and ensure that its decisions and recommendations have been given the follow-up actions recommended.

##### 4.1.2.2 Legislative support

Legislation is essential to provide legal support for action to regulate the health and environmental aspects of water resources development projects. In countries where the existing laws provide adequate legal support, the Panel felt that additional legislation would not be helpful and should be avoided. Instead, measures should be studied and proposed for the application and enforcement of the existing laws.

Such legislation should address the public as well as the private sectors, and should be in accord with, and be developed within, the existing laws related to water and development.

Any legislative act must, inter alia, identify the administrative mechanism and provide for resources required for its implementation and follow-up.

##### 4.1.2.3 Training and research

The Panel noted that the engineers engaged in planning, designing and constructing water-works, and those operating such projects, have little or no academic background on the health and environmental implications of their work. Similarly, most health specialists and environmentalists have little knowledge of engineering techniques and practices. No real progress can be expected from any measures to secure health and environmental safeguards in water projects unless and until these two groups of specialists understand each other's problems and learn to communicate.

As a first stage, and to obtain early results, the existing engineers in public and private sectors should be trained by means of short courses, seminars and workshops, and through the preparation and distribution of guidelines and manuals of operations. Simultaneously, the course content of the engineers (hydraulic, civil, irrigation, etc.) at technical schools should be studied with a view to introducing information on the health and environmental implications

of engineering activities. This information may be quite simple and concise, designed only to arouse an awareness of the consequences involved. It should be given preferably in the last year before graduation. Similarly, the staff of the health and environmental sectors need to be aware of certain engineering aspects of waterworks and to understand simple engineering techniques and practices related to health and the environment.

As a second stage, more specialized courses and seminars can be organized for those directly involved in waterworks and more detailed guidelines and manuals produced and distributed. Multidisciplinary seminars where various specialists exchange experience and discuss common problems could be very valuable.

Field research to study alternative methods and approaches to problems is a necessity at the national level. This task should normally be assigned to the existing scientific and technical institutions.

#### 4.1.3 At the regional and global levels

##### 4.1.3.1 Network of collaborating centres and inventory of projects

The Panel noted that information on water development projects is scanty. Reliable data are not available on the number, location, size, type, etc., of these projects. On the other hand, external collaboration and assistance cannot be organized in time until an inventory of these projects is made and kept up to date. Also, field studies and research are needed on certain problems common to water projects or on newer techniques and practices. The Panel felt that for such activities, collaborating centres should be designated in geographically well-distributed locations. These centres, which would be selected from already existing national institutions, would establish contacts with competent institutions involved in the development of water resources in the countries covered by the centre and collect the information and data required. If a national coordination board existed at the country level, the collaboration would be easier and could be secured through the board.

The collaborating centres could also be used for the dissemination of information and for maintaining the national boards and projects up to date on the new technologies and developments in this field.

##### 4.1.3.2 The international reference centre

The Panel recommended that an international centre should be organized to receive information collected by the collaborating centres and directly from the national coordination boards or even the projects. The information thus collected should be compiled and issued regularly to national, international and bilateral agencies involved in such developments.

The international centre should also study the technical needs in field projects, carry out studies and issue technical reports. The centre would collaborate closely with the secretariat of the Panel in the development of the information system and in the functioning of the global programme support promoted by the Panel.

##### 4.1.3.3 International collaboration

The Panel was of the view that the activities at project, national and global levels should be promoted, coordinated and provided with necessary programme support. This will include action to provide technical and operational collaboration at the project and national levels, namely, assistance for planning, operations' evaluation, and training and research as well as for promotional approaches with a view to setting up the necessary institutional framework at these levels. At the global level the major action will be the development of global policy and guidelines for health and environmental impact studies and the incorporation of health and environmental safeguards in water resources development projects. This implies the formation of a multidisciplinary and intersectoral institution to bring together the experts in various fields related to water resources development as well as the organizations



executing and financing such projects for mutual collaboration and functional coordination of activities. By establishing the Panel, the executive heads of WHO, FAO and UNEP have taken the first step towards setting up an institutional framework to serve the above purposes, and it is expected that other concerned international organizations will soon join in this enterprise. The Panel's membership already includes experts with vast international experience in different aspects of water resources development at policy making, financing and technical levels. Other personalities and experts will be designated to the Panel to help expand its activities and to strengthen its programme support in the areas of its responsibilities.

#### 4.1.3.4 International financing and policy considerations

The Panel noted that many of the global activities and some of those at national and project levels required international financing. At project level and sometimes at national level funds for health and environmental studies and activities may be secured from the overall project's capital and operational funds. The Panel was strongly of the opinion that international or bilateral financing should be provided only on the strict condition that the project plans and designs satisfied health and environmental requirements. The Panel recommended that a similar condition should be considered by national funding agencies; to that end legal support and legislation might be required.

One of the Panel's global activities would be to endeavour to induce international and bilateral financing agencies to support the incorporation of health and environmental safeguards in water resource development projects either by allocating funds specifically for that purpose or by earmarking certain funds already allocated to such projects.

#### 4.2 Major issues

##### 4.2.1 The transfer of information - principles for a global information system

Agencies and organizations dealing with environmental management in developing countries must be largely concerned with indirect tasks such as human resources development and training, the development and promotion of appropriate technology and methodology, and the mobilization and education of people in the communities.

The Panel felt that, if these agencies were to perform these and other tasks as efficiently as possible they must have at their disposal some mechanism for collecting, compiling and transferring available information both from the country itself and from external sources. The information required would comprise knowledge, experience, technology and methodology. The target groups would be planners and engineers, public health workers and community workers, and, perhaps indirectly, the users.

The mechanism of information exchange and transfer would perform the following four actions (in order of increasing involvement in the national programmes):

- information exchange, including reference and referral services, and development of guidelines and training material;
- training courses, workshops and seminars;
- research and demonstration projects; and
- technical cooperation in the development of material support programmes and facilities.

These activities could best be undertaken by a network of collaborating centres at national, regional and global levels. Such a network would be instrumental in exchanging information and triggering project initiation and development. The first concrete approaches should be modest, however, according to the principle "think big, but start small".

The national centres would have a variety of functions to perform, including information search, collecting and exchanging field experiences, evaluating projects and publishing information on successes (and failures if possible), organizing courses, promoting new designs and methods, and triggering research. Conditions which must be fulfilled to ensure the success of the national centres are:

- political commitment in the government;
- fitting of functions into those of the national coordinating board (if any) and into national policies and plans;
- acceptability to other professional and operational organizations in the country;
- good working relations with groups in the country and outside;
- professional competence of the centre's staff;
- involvement not only in technical matters, but also in economic, managerial, and social matters.

Where possible existing regional centres or bodies should be made part of the network.

Concrete requirements of the centres would include manpower (e.g. one fully responsible professional, plus administrative assistance), finance (allocated funds for salaries and operational costs) and clear mandates from the parent institution.

Other requirements would be:

- proper internal and external management and coordination;
- clear agreement on tasks, responsibilities and lines of command;
- adequate communication and reporting procedures.

The above conditions and requirements should be aimed for even if they cannot always be met.

The centres and their activities must be user-oriented and practical in nature. They must also be dynamic - not waiting for requests, but "outgoing" to undertake tasks.

The functions of the global reference centre would include: building up a body of exchangeable knowledge and experience among the partners; providing expertise and developing guidelines; providing logistic support; developing collaborative projects, including training courses; encouraging the development of functions in national centres; and acting as intermediary in finding financial resources.

The Panel recommended that the global centre functions should be organized within an existing centre with experience in these functions and enjoying adequate professional and administrative support. It could be extended as projects were initiated and developed.

The following steps were suggested as a possible way of proceeding with the establishment of such an international reference centre:

- select a centre where the global functions can be performed;
- enter negotiations in order to have the necessary staff available (one professional, one administrative assistant);
- develop first plan of action (together with Panel and secretariat);
- start working.

It was noted that the dissemination of information is often linked with the start of a new publication. But this may not be effective if disciplinary boundaries are to be bridged. In this context, the Panel noted with interest FAO's "International Support Programme for Farm Water Management". It would be useful if the information materials issued under that Programme could include messages on the health and environmental implications of irrigation works, and on how adverse consequences could be minimized through good farm water management.

#### 4.2.2 Intersectoral collaboration

The Panel recalled the United Nations General Assembly resolution 34/58 of November 1979 on Health as an Integral Part of Development, and noted that several other resolutions stressing the role of health as a component of socioeconomic development had been adopted by other international organizations and at various conferences. To have any material impact, these resolutions must be considered and applied at the national level. For this, ministries of health and those responsible for the environment should play an active role. In countries where the ministry of health also covers the environment, decision-making and collaborative action are considerably simpler.

The ministry of health may be considered as playing the leadership role in intersectoral collaboration for the protection of health and the environment. As such, it needs first to create, either within its administration or based in the planning ministry, an office for the coordination, initiation and follow-up of all nationally and internationally supported activities related to water resources development projects. However, the ministry of health is rarely an influential ministry. Where the planning ministry is strong, there is much opportunity for emphasis of health concerns in the dialogue between it and the international financing institutions over project design and selection. Where a project involves external finance and commercial contracts, the person responsible for drafting terms of reference in the ministry or agency concerned is in a uniquely strong position to ensure that adequate attention is given to health and environmental aspects of water developments.

Sometimes, interdepartmental coordinating committees or boards have been set up to deal with the prevention and control of water-associated diseases. That is the case, for example, in the Sudan, in connexion with three large irrigation schemes. Where such a body does not exist, bodies set up for intersectoral collaboration in other fields may be used in relation to water resources development.

In the massive task of water resource and water supply engineering throughout the world, private consulting firms can have an important role. The tasks between now and the end of the century include rehabilitation of about 50 million hectares of irrigated agriculture, increasing the irrigated area by about 25 million hectares to meet the food targets, and providing safe water supply and sewage disposal facilities to about two-thirds of the world population, in addition to other basic needs of development.

Such tasks require adequate technical capabilities both qualitatively and quantitatively in the public and private sectors. However, trends indicate that there is a decreasing contribution of firms from the developed countries in solving the problems of developing countries; this is a result of the increasing technological gap, the firms' increasing involvement in the new era of technological advancement in the developed countries and a few wealthy developing countries, and the high cost of the services provided by these firms.

Necessary national and international action to meet this situation should include an assessment of the existing capabilities of consulting and contracting firms within developing countries by regions, and of the constraints on the development of capabilities. Such constraints may take the form of inherited attitudes and prejudices, or of institutional arrangements at both national and international levels that may be hindering recognition and employment of the private sector.

It is necessary to foster cooperation between firms, whether private or government supported, in adjoining countries, to remove restrictions on their operation beyond their

home countries, and to encourage joint ventures between firms from both developing and developed countries, with a view to the transfer of technology and the improvement of capabilities.

#### 4.2.3 Education and training in environmental management for vector control

The Panel's discussion on this subject centred on the need to train engineers working in water resources development projects to be aware of the public health problems associated with their work. Existing training programmes were examined, ways of improving them suggested and other approaches to training discussed.

##### (a) Existing courses

There are many universities, polytechnical institutes and colleges throughout the world offering courses dealing with water resources development. Both undergraduate and postgraduate programmes are available.

Undergraduate programmes. Whilst recognizing the constraints in undergraduate engineering programmes, which tend to be heavily lecture and laboratory oriented, and to make extensive demands on the students' time, the Panel felt it was important to create an awareness of health and environmental issues in development, preferably during the last year of technical training.

In the more developed countries, courses on environmental and social issues are already included in engineering programmes because of social pressures on engineers to be much more aware of the consequences of their work. Short training on health issues needs to be organized and included in the current courses.

In the developing countries, mostly within the tropics, a detailed awareness of the health problems associated with water is a vital part of a civil engineer's training. This requires a more detailed course of study, so that young engineers are not only aware of the problems of vectors and vector-borne diseases, but able to initiate preventive action against them.

Postgraduate programmes. The Panel felt that the steps recommended for undergraduate programmes were equally applicable to the postgraduate ones. However, there should be more opportunity in a specialized programme of this type to cover health problems in more detail, particularly in courses intended for engineers working in tropical regions.

It was noted that a recent survey of postgraduate engineering courses in the United Kingdom indicated that many included special lecture courses on public health and the prevention and control of communicable diseases, but there was little emphasis on the vector-borne diseases associated with development. A recurring comment from course organizers was that, although they recognized the importance of the study of vector-borne diseases, severe time constraints prevented them from including extra material.

##### (b) Action to improve the situation

Two possible courses of action were discussed. The first was the preparation of special material and teaching aids which could easily be implanted into existing courses or offered as an additional or optional subject at all levels of training. In preparing such material, use could be made of the latest teaching aids, including video and tape recordings, colour slides and handbooks. An attractive package of that kind would be readily accepted by colleges. An active campaign to market the package and ensure its use would be essential.

The second approach would be to organize special courses or events related specifically to major vector-borne diseases for engineers engaged in development projects. This could be done in several ways.

Advanced technical workshops. The Panel agreed that the necessary orientation might best be given by starting at the top. Here the need was not so much for training as for a sharing of experiences and the transfer of new ideas and approaches. Participants in such workshops should come from a wide range of geographical locations. They should include not only persons from senior engineering levels within government-supported or private firms, but also decision-makers and planners from other scientific and administrative entities.

Expert workshops. These would provide for detailed discussion and experience sharing among experts, including engineers, epidemiologists and biologists. The results of such workshops could perhaps be published by WHO, FAO or UNEP as a means of effectively disseminating information to practising engineers and agriculturalists.

Short training programmes. An effective way of providing training for engineers already engaged in development work is to provide special short, intensive courses. Programmes ranging from one or two weeks up to three months are organized by many universities and colleges throughout the world for this purpose.

Syllabus. The syllabus should maintain a careful balance between engineering and biological subjects. Among the topics which should form the core of any course are: major vector-borne diseases related to water resources development; the biology and ecology of vectors and intermediate hosts involved in disease transmission; and chemical, biological and environmental management approaches to vector control. Practical case studies should be used to demonstrate the successes and shortcomings of techniques.

The Panel noted that a central problem in attempts to improve engineering and design practice for vector prevention and control is a lack of sufficient expertise. The extensive and largely successful use of pesticides as the primary weapon against vectors has led to a lack of both experience and expertise today in the use of other methods.

Because of the biological specificity of vector species for particular habitats, a detailed ecological understanding is essential for water resource development design. Biometric data on the various vectors is the necessary basis for such understanding, and a proper reference to their geographical distribution is a condition for the effective implementation of species sanitation as a control measure. Training in these aspects should be provided.

It was agreed that key institutions such as schools of public health with an interdisciplinary organization adaptable to changing needs could do much by providing specific training to rectify this situation. The feeling was expressed that travelling seminars combined with field demonstrations and practice might be useful in this connexion.

#### 4.2.4 Assessment of impacts on health and environment

If the adverse effects of water developments on health are to be prevented and health is to be promoted, some form of accurate assessment of the risks and proposals for containment must be made. In other words, there is need for a health equivalent of the environmental impact assessment.

The analogy needs critical consideration. The environmental impact assessment provides a formal mechanism for ensuring that thought is systematically given to the environmental hazards, predictions are made as to what may occur, and opportunities provided for corrective action. All these steps are needed in respect of health, but the extremely cumbersome and expensive formal steps of the "environmental impact statement" carried out in certain developed countries form a less suitable model. Moreover, there are opportunities in many water development projects for positive improvements to health. To emphasize both the analogies and the differences, what is needed may be called a "health opportunity assessment". It is in parallel to and overlaps the environmental impact assessment, but has man as its primary focus, in his relation to the environmental change.

There are at least three components to a health opportunity assessment. The first is an epidemiological statement of the existing health problems of the population concerned and their health care facilities. Second is a prediction of the likely changes in relevant aspects of the environment and people - what vectors will increase, how will their contact with man change, and so on. On the basis of this epidemiological baseline condition and the prediction of risk, the third step, of proposing measures to improve health, will be made. These will affect the design, construction and management of the water resource development. The completeness of this review can be aided by checklists and matrices of hazards (see WHO Technical Report Series, No. 649, 1980). Whenever possible a fourth step will express the risks and the costs of prevention in economic terms.

This provides a framework for planning. It should be kept flexible and the degree of detail will depend on the scale of the project, the complexity of the health and environmental problems encountered, and the availability of experienced staff - a well informed professional opinion may be of greater value than many studies by inexperienced staff. Such an opinion on a project would consider costs and benefits, avoidable and unavoidable hazards to health in the long and short term, and any irreversible consequences of proceeding with the project; only an informed judgement can determine the amount of detail needed.

#### 4.3 Incorporation of environmental measures for safeguarding health in projects

Most land and water developments are in themselves a form of environmental management, aimed at securing production and income to support agricultural communities. The environmental management measures for health protection must therefore be recognized as a component within an overall management plan, and cannot be applied in isolation from such a plan.

Health issues should therefore be treated as one element in a very complex situation comprising diverse types and levels of development. Large-scale schemes with heavy investment, centralized planning, operation and control generally offer better facilities for health protection than the national average conditions. Nevertheless, some of these large schemes have failed for one reason or another to achieve expected levels of production and have been slow to give returns. There is therefore a tendency in a number of countries to give more emphasis to smaller schemes using local initiatives and simpler technologies which give quicker returns for lower per capita or per hectare investment.

This type of scheme presents the same kind of health problems as the larger schemes, and sometimes more acute ones because of the closer proximity to settlements and the difficulties of providing health protection facilities for highly dispersed developments with decentralized control and management, and consequent problems of access to technical and institutional support.

The Panel reviewed the recommendations of the WHO Expert Committee on Vector Biology and Control, WHO Technical Report Series, No. 649, 1980, in the context of land and water development projects. In discussions, particular reference was made to the recommendation for studies of the socioeconomic impact of environmental management measures, and it was further noted that such studies should extend over the range of socioeconomic issues associated with these developments, covering both positive and negative aspects.

Attention was also drawn to the need for feasibility studies and for cost/effectiveness and cost/benefit analyses of different environmental measures for vector control in order to select the most suitable methods for given situations.

##### 4.3.1 Cost aspects

The Panel recognized that certain environmental management measures were of a special nature and were not currently accepted practice in water impoundment and use projects since they inevitably led directly to an increase in costs. However, many important and costly measures, such as canal and reservoir water level management, cannot be considered only in this way. Whilst they may be extremely effective in controlling vectors, their inclusion in

a project is more likely to be based on the resulting economic advantages of improved water use or higher crop or energy production than on improved community health, which may be considered a secondary issue. However, the long-term cost of health and environmental protection that may arise from the absence of necessary safeguards should be considered when assessing a project's cost/benefit. Clearly, the ideal design will aim at increased productivity with reduced disease. The main implication of this is that improvements can be achieved through the application of good engineering practices, provided that the personnel is highly skilled enough to undertake these tasks and is sufficiently aware of the health and environmental implications of the work.

Many of the necessary environmental management measures for vector control could be justified on engineering grounds alone, e.g., canal cleaning and maintenance should be considered as an engineering requirement instead of a vector control requirement. Under these circumstances, the costs should not be allocated to disease control.

In costing projects, it is important that the possible adverse health and environmental consequences of water development should be priced in terms of the expenses required to remedy the situation. If the long-term costs of adverse consequences are included in the overall project costs, the cheapest engineering alternative design with inadequate health and environmental safeguards might not be the most economical.

#### 4.3.2 Legal aspects

Legal measures affecting vector control have passed through a number of phases. At one stage, their aim was, in effect, to provide incentives for insecticide use. At present the tendency is towards restrictive regulations, such as the required use in some developed countries of the environmental impact assessment technique applied to the proposed large-scale use of chemicals, particularly for agriculture.

Other potential regulatory actions relative to vector-borne diseases lie in the development of national legislation on water-related occupational diseases and the provision of measures to protect the workers involved through requiring, for example, the use of mechanical methods instead of manual labour for clearing infested canals. However, these actions touch only on the fringe of associated health impacts of water development.

The concept of prevention, now beginning to penetrate the law, aims to remove the cause of the problem - often due to lack of consideration of health and environmental aspects in development planning, design or management. However, in fact, legislation related to the control of water-associated vector-borne diseases is at best scanty, inadequate and dispersed.

It should be part of national land-use planning legislation to identify and delimit the area within which man-vector pathogen contact can occur. It belongs to water legislation in support of the provision of safe and convenient domestic water supplies and sanitation to minimize human contact with infected waters.

Each of these legislative sectors usually falls within the responsibility of a particular ministry, department or agency for which the problem of vector control may be only a minor issue so that there is no autonomous, independent and self-contained law on water-related disease and vector control. Yet this subject shows externalities and conflicts that necessitate either a change in the decision-making process or some "other means" of accommodating them. One such change in the decision-making process would be the acceptance and introduction of the concept of health opportunity assessment, not only at the time of project implementation but also at the planning stage. This would not necessarily entail the imposition of a particular formal and sometimes unrealistic procedure such as the "environmental impact statement".

In the countries which suffer most from water-related disease, the development of a comprehensive, self-contained regulation on this problem, executed by the Ministries of Agriculture, Health and Public Works, would deal mainly with:

- environmental and health impact assessment,
- land use restrictions,
- engineering practices of environmental management methods such as drainage and filling,
- related building rules,
- water management measures for vector or disease prevention and control,
- vegetation management,
- powers of inspection, and
- sanctions.

In discussion it was noted that legislation in the USA has long extended to regulations on the impoundment of water, requiring attention to both environmental and health aspects. Similarly the creation of mosquito abatement districts, empowered to collect taxes for their functions, has a legal foundation. In some developing countries also, regulative legislation to prevent or reduce mosquito production exists on, for example, rice culture.

The Panel strongly recommended the formulation of standards related to development projects which would protect health levels and the environment. The issue of enforcement was stressed in the more general context of licensing and granting permits. Periodic monitoring of approved activities was considered essential to ensure that the required levels of management and control are maintained. The specific case of waste water re-use was mentioned in this connexion.

##### 5. Integration of Simple Environmental Management Measures into Vector Control Programmes

Drainage, land-filling and other environmental management measures were used successfully for malaria control until residual pesticides became available in the late 1940s. Since that time reliance has been placed almost entirely on chemical insecticides for the control of disease vectors. Vector resistance to insecticides has developed, public objection to insecticide application has arisen, and insecticide costs have increased greatly. These factors have led to the reconsideration of applying environmental management measures in disease control programmes as a component of the integrated control strategy.

The Panel noted that the integration of environmental management measures in disease control programmes is basically intended for the development and implementation of a control strategy that is more effective, longer lasting, safer to man and to the environment, and more economical.

Among the operational implications of the integration process was the need for retraining the existing staff of the disease control programme and for organizational reorientation of the disease control service, to enable the staff and the service to carry out these measures effectively. The problem of the local adaptation of technical and operational procedures must also be resolved before integration can be soundly planned and implemented. The most practical approach towards integration would therefore be to begin with the training of staff and the organization of field operation trials to assess and to adapt the various technical and operational procedures to local conditions and resources. At a later stage, organizational reorientation of the disease control service can be undertaken. On completion of these preparations, integration may be introduced into the disease control programme on an operational scale.



Financial implications of the integration would not be serious. The addition of environmental management measures in a disease control programme should permit a gradual reduction, leading possibly to an eventual withdrawal, of certain chemical control operations in many situations. This will result in savings which can be used to cover, or largely offset, the costs of these measures. Further, many simple measures, such as draining or filling small depressions, can be done by the programme staff or by the local population themselves. However, additional funds would be needed during the initial stage of integration, in particular for conducting the necessary studies and field trials.

A considerable amount of groundwork has been carried out in connexion with the organization of training seminars for national disease control programme staff. Several member states have also been approached with suggestions for the initiation of field operation trials in their malaria control programmes.

The Panel was in agreement with the concept of integrating simple environmental management measures into disease control programmes and endorsed the approach being followed for integration. It further suggested that funds available for technical cooperation among developing countries (TCDC) should be tapped for this activity.

#### 6. Programme of Work for the Panel

The Panel reviewed the proposed programme of work for the period from October 1981 to September 1982, together with the estimated costs, as submitted by the secretariat and made specific comments on several items of the proposed programme.

In general, the Panel was much torn by the conflict between the need to begin work on these important matters without delay, and the very limited funds at present available for the work. It was considered necessary to have the substantial long-term goals reflected in this report but to make a modest beginning.

The Panel was fully conscious that the estimates shown in the proposals were on the low side even for initiating these basic work items. However, in view of the anticipated delay in starting activities, the Panel decided not to increase the estimates at this stage and approved the programme as proposed. It nevertheless suggested that the secretariat should investigate the projects in more detail, and agreed that the budgets given in the proposals should serve as "seed money" to cover investigations and initial work.

The detailed programme proposals are included in Annex I and the approved programme is summarized below:

<u>Item</u>	US \$	
(a) Organization of the next Panel meeting	40 000	
(b) Secretariat meetings	-	
(c) Establishment of an international information system	10 000	
(d) Initiation of an inventory of water development agencies and projects	8 000	
(e) Compilation of bibliographies	5 000	
(f) Issuing newsletters	5 000	
(g) Strengthening of the secretariat	15 000	
	<hr/>	
	Total (annual contributions)	83 000
	<hr/>	
(h) Participation in multidisciplinary missions (extrabudgetary contributions)	75 000	
	<hr/>	

Specific comments made by the Panel on some items of the proposed programme of work are as shown in the following paragraphs.

## 6.1 An international information system

### 6.1.1 The national basis

It is essential to achieve coordination at national as well as at international levels if progress is to be made. There is a need for some form of intersectoral water resources development coordination board in each country; on the other hand, the Panel was extremely wary of creating new committees. One possible solution would be to utilize the committees set up nationally in relation to the International Drinking Water Supply and Sanitation Decade for this purpose. The Panel requested the secretariat to pursue this approach in a few selected countries, to develop a model for this process of national coordination, and to report the experience to the second Panel meeting.

### 6.1.2 International reference centre

For the effective work of the Panel, there is a need for some form of centre performing such functions as the compilation and dissemination of information on water resources development projects as received from countries; compilation, analysis and dissemination of technical information relating to health and environmental implications of water resources development and environmental management; bibliographical services, field research and other activities. At the minimum, such a centre will need to act as a focus of expertise, to collect and disseminate information and also to act as an intermediary in having various technical functions carried out.

The Panel therefore considered it necessary to establish a reference centre or centres and recommended that during this first year, contact should be made with institutions which had the potential to serve as a reference centre, detailed proposals should be prepared on the functions and cost of such a centre, and steps should be taken to secure its financing. It was likely that prospective funding in the coming year would be inadequate to provide the estimated \$ 100 000 that would be needed annually over a prolonged period if a reference centre were to be viable even with a minimum programme. The Panel encouraged the secretariat to proceed with the above steps and asked it to present a progress report to the next Panel meeting.

A network of other collaborating centres was also envisaged. The Panel was clear that initial contact should be with a small number of interested countries and that these links should be well developed before attempting to spread more widely. Countries having already such centres or boards should be given preference in selection and the experience gained in developing these centres into the kind of institutions required for the network would be of considerable value in designing the follow-up action plans for the ensuing years.

## 6.2 Inventory of agencies involved in water resources development and of such projects

Because of their potentially vast number and scope, agencies and projects would necessarily have to be screened and only those of direct relevance and interest to the Panel should be included in the inventory. However, there was some difficulty in defining which institutions and projects should be considered and in deciding on the scale and type of activity to be included. Nevertheless, it was accepted that one such limit would be implicit in the initially small-scale start to the activity, since only a few countries would be considered at the beginning. The general feeling of the Panel was that a better formulation of the inventory project was needed, especially as it may turn out to be excessively demanding on manpower.

### 6.3 Compilation of bibliographies

The proposal relating to bibliographies drew the comment that there are already a number of such bibliographies, and it would be useful to assemble these. However, a number of initiatives aimed at collating this type of information are at present in hand and it is advisable to give careful attention to obtaining and assembling the data in a form enabling it to be transferred to the user. The suggestion was made that costs of a bibliography may be partly defrayed by making it a priced document.

### 6.4 Issuing newsletters

In the discussions on the newsletter project, support was given to the proposal, but it was emphasized that this is a labour-intensive activity, which can best be handled by full-time staff involved in associated technical and administrative activities, rather than by occasional consultants who may not have the necessary close topical connexions with the work.

The current proposal is for a quarterly newsletter. It was suggested that a higher frequency was desirable, but some caution was expressed regarding costs of production and of distribution, which are rapidly escalating. While it was recognized that publication might better be deferred until the proposed reference centre was established, the secretariat considered that an immediate start to the newsletter proposal would be to the advantage of the Panel, and it was hoped that funds could be found to start publication shortly, with a report on this first Panel meeting. The Panel accepted this proposal.

### 6.5 Participation in intersectoral missions

In the past, the inclusion of health-related personnel in missions to prepare or carry out feasibility studies for water development projects has been intermittent and irregular. It is highly desirable that a much more active attitude be taken towards participation in such missions. The Panel was strongly in favour of encouraging such participation, which could be done both by drawing the attention of the responsible ministries, departments and agencies to the serious consequences of ignoring health and environmental impacts and to the need for appropriate studies and protective measures, and by offering assistance with such missions. Normally, the feasibility study budget should cover the costs of such studies and therefore there should be no cost to the Panel or the concerned United Nations agency. In the case of already functioning water resource developments and in those of a small and scattered nature, it is likely, however, that there will be insufficient funding for, or attention to, health matters, and the Panel recommended that up to 15 man-months of consulting time be made available to the secretariat for activity in this area. It is envisaged that short-term consultants in the fields of epidemiology, entomology, engineering, biology and environmental sciences may be used for this purpose.

## 7. Project Proposals

The project proposals, as submitted by the secretariat, were reviewed and commented on by the Panel. The original proposals are included in Annex II, and the titles of the projects proposed, together with the estimated costs, are listed below:

SUMMARY

<u>Project No.</u>	<u>Title</u>	<u>Estimated cost</u>
		US \$
(a)	Strengthening of engineering and agricultural educational institutions in environmental management for disease/vector control	15 000
(b)	Seminar on prevention and control of health and environmental problems in water resources development projects (to be held in Europe, without field observations)	20 000
(c)	Seminar on prevention and control of health and environmental problems in water resources development projects (to be held in Sudan or another developing country, with field observations)	20 000
(d)	Training courses on prevention and control of health and environmental problems in water resources development projects in arid and semi-arid zones	
	Course 1 in Kenya	85 000
	Course 2 in Mauritania	100 000
	Course 3 in Paraguay	100 000
(e)	Preparation of training aids	15 000
(f)	Organization of pilot operations in disease control programmes for incorporating simple environmental management measures	50 000
(g)	Preparation of guidelines for carrying out health/environmental impact studies	12 000
(h)	An assessment of the effectiveness and the long-term economy of canal lining for vector control	20 000
(i)	Field tests of equipment for environmental management related to vector control	55 000
(j)	Studies on the socioeconomic impact of environmental management measures	40 000
(k)	Training course in vector ecology and control in development	22 000

The comments made by the Panel on the specific projects are given in the following paragraphs:

7.1 Strengthening of engineering and agricultural educational institutions in environmental management for disease/vector control

The Panel discussed this proposal in detail and recommended that two or more interested training colleges should be selected for appropriate strengthening. Preferably, there should be one anglophone and one francophone college among them, probably situated in developing countries. It was considered that the training needs of the agricultural and the engineering institutions should be considered somewhat separately. A consultant should

therefore visit the selected colleges to review their curricula and to propose the incorporation of components to deal with the health implications of water resources development, the methodologies for carrying out health opportunity assessments, and the possible measures that could be used to limit adverse consequences of the water resources developments. The curricula should then be revised accordingly in the selected colleges with the assistance of the consultant. It was considered essential to publicize the results in order to encourage other colleges to make similar modifications to their curricula in the hope that it would soon become a standard part of undergraduate teaching. In the discussions on this project, emphasis was placed on the long-term nature of undergraduate training and the need to bear in mind changes in agricultural techniques. The main purpose of such training would be to increase awareness of the issues rather than provide detailed knowledge.

#### 7.2 Seminar on prevention and control of health problems in water resources development projects - to be held in Europe, without field observations

The experience obtained so far encouraged the Panel to propose that a seminar should be held within the next two years in Europe on the prevention and control of health and environmental problems in water resources development projects. It would be specifically designed for practising engineers and those in related disciplines. It was envisaged that the seminar would last no longer than one week, would accommodate up to 50 participants and would involve also the participating agencies of the Panel and other interested parties. It should deal with water-associated vector-borne diseases, their prevention and control, and related topics of environment and health.

It was felt that it was crucial for such a seminar to be held in a residential institution so that those attending could interact outside the formal sessions. It was also envisaged that following one international seminar various self-supporting national ones may follow. It was considered that participants would meet their own costs for travel and subsistence, and that funds would have to be provided only for the organization of the meeting.

#### 7.3 Seminar to be held in a developing country similar to the preceding but with field observations

After extensive discussion it was felt that the Blue Nile Health Project in the Sudan provided ideal conditions for such a meeting and the Panel recommended that a seminar be held there in 1982 or 1983. It was believed that, in addition to engineering and constructional experts, biologists, epidemiologists, sociologists and economists, it would be desirable to include among the participants senior civil servants involved in decision-making regarding water resource development projects. It was pointed out that some of the participants employed by governments of developing countries may have difficulty in raising funds to attend the seminar and that requests for funds to assist them should receive sympathetic consideration.

The opinion was expressed by various members of the Panel that the health situation and needs in South-East Asia differed greatly from those in Africa and the Panel strongly recommended that, funds permitting, consideration should be given to holding a comparable seminar in a country in South-East Asia.

#### 7.4 Training courses on prevention and control of health and environmental problems in water resources development projects in arid and semi-arid zones

It was considered that the need for this course was particularly great in some semi-arid areas. Over the next three to four years an attempt should be made to hold three courses on water management for vector control in arid and semi-arid zones, each able to deal with approximately 20 participants. There should be a geographical spread in the siting of these courses and the proposal was made to hold one in English in Kenya, one in French in Mauritania and one in Spanish in Paraguay.

Major subjects to be covered will be: (1) water-associated vector-borne diseases; (2) socioeconomic development of arid and semi-arid zones and its relationship with water and

agricultural development; (3) health aspects of water and agricultural development; (4) environmental considerations in water and agricultural development, environmental or health impact studies; (5) environmental management methods for vector control, other methods for vector control, integrated vector control, and the comprehensive approach; (6) planning environmental management for vector control, planning land and water resources development projects, planning community development projects by local participation, and intersectoral collaboration; (7) case study.

In the discussion of this project emphasis was placed on the need to look at future changes in the effects of environment upon vector control and particularly on the increasing aridity of some of the environments that were being irrigated.

#### 7.5 Training course in vector ecology and control in development

The proposal for this course was formulated on the basis of replies to a questionnaire to assess the potential demand for a course of about one month duration, aimed at improving the knowledge of engineers, agronomists, planners and other disciplines in measures for health protection and vector-borne disease control in development.

In the discussion of this project, it was pointed out that a highly intensive course of this type was approaching the content of a one-year master's degree course and it was queried as to how this acceleration could be achieved.

Such a course would require a relatively large cadre of staff with long and varied practical experience. This breadth and diversity of experience would be applied to well defined objectives in a necessarily limited range of disciplines. The course would need to be held in an institution offering ready access to all required training facilities.

Although there might be advantages in selecting a site in a developing country and closer to demonstration sites, it was thought that the previous field experience of the instructors and of many participants could be drawn on to provide this background. Many of the participants were involved in development activities in a number of countries and regions, and would benefit from the more comprehensive approach possible in an institution capable of providing a global background, without which it was unlikely that the intensity and relatively short duration could be achieved.

It was recommended that the course content should be rather broader than the specific proposal for vector ecology and control, in order to place it within the more general setting of the health effects of development, and to provide an appreciation of the chain of events associated with land and water development in particular.

This project was considered typical of the kind of continuing education which is called for from schools of public health and tropical medicine, and the Panel endorsed the proposal. It was recommended that the secretariat and the London School of Hygiene and Tropical Medicine, in association with other appropriate institutions, should prepare it in greater detail and investigate sources of funding to meet the costs of preparing the course and those of participants who may not be in a position to fund their training personally or through their employers.

#### 7.6 Preparation of training aids

The Panel noted that training aids have been prepared in the past by national and international health agencies for teaching engineers, biologists and physicians the technical aspects of vector disease control. Much of the available material on the management techniques for vector control is quite old and applies only to problems in limited geographical areas. The excellent material relating to global malaria eradication is not very relevant to the environmental management principles being stressed. It was agreed that the existing training aids, including film strips, films and manuals, should be reviewed for possible purchase. Whenever new aids must be prepared the Panel stressed the importance of sound technical direction and of scenarios written around ongoing vector control projects. However, the film makers and health educators must be allowed to carry out their craft which in itself enhances the usefulness of the aids produced.

### 7.7 Organization of pilot operations in disease control for incorporating simple environmental management measures

It was agreed that operations involving the application of simple environmental management techniques are vital in demonstrating the feasibility and effectiveness of such measures. Much scepticism exists in regard to the possibility of managing the numerous but small-scale problems and village sites with limited resources. More credibility is attached to the large engineering enterprises but the problems around villages must not be ignored. In selecting sites for these demonstrations, the need for valid evaluation must be kept in mind. Initially the demonstrations should involve on-going "integrated" vector control projects where, for example, routine larviciding for malaria control could be replaced by simple methods of source reduction. The most exciting aspect is the possibility of emphasizing community involvement and participation in carrying out simple filling and drainage projects.

### 7.8 Preparation of guidelines for carrying out health/environmental impact studies

The Panel agreed to support the preparation of guidelines which would be of considerable help to those carrying out health/environmental impact studies. It was considered that the guidelines may need to be longer than the proposed 20 pages but they should be limited to the major issues and not go into great detail. The guidelines would be valuable for use in training programmes and for those already trained. They were not meant to be used by untrained workers in the field.

### 7.9 An assessment of the effectiveness and the long-term economy of canal lining for vector control

The Panel agreed to support this project but recommended that it emphasize canal design for vector control rather than considering lining alone.

### 7.10 Field tests of equipment for environmental management related to vector control

Existing power machinery for earth moving and vegetation clearing is expensive and often unreliable. Existing handtools are extremely inefficient. The Panel agreed that this field-testing project can improve that situation by recommending improvements and encouraging manufacturers to improve and develop equipment.

### 7.11 Studies on the socioeconomic impact of environmental management measures

The Blue Nile project is collecting information that relates directly to this proposed study. Panel members agreed that the additional information needed for this socioeconomic study could conveniently be obtained by strengthening the existing Blue Nile project. This is an ideal opportunity to obtain urgently needed information effectively and efficiently. The study will have to be carefully designed to take account of the confounding elements in the environmental complex, but it was agreed that WHO has the expertise to do this.

## 8. Policy Matters

### 8.1 Invitation to other agencies to participate

It was the view of the Panel that every effort should be made to make use of and support the work of existing national, regional and international bodies responsible for or involved in water resources development. In this connexion, the report and recommendations of the Panel should be brought to the attention of such groups. Every effort should be made to explain the objectives of the joint WHO/FAO/UNEP Panel. The Panel felt that the secretariat could be represented at the next meeting of the United Nations Intersecretariat Group on Water Resources to be held at the Headquarters of WMO Geneva in October 1981. It was felt that invitations for additional agency participation in the Panel, while desirable, should initially be limited to UNDP, UNICEF and the World Bank in order not to dilute the main objectives of the Panel. Other interested and concerned organizations may be invited to attend meetings of the Panel prior to their consideration as participating organizations.

## 8.2 Membership

In the discussion on Panel membership, the question of the desirable balance between political influence and technical expertise was raised. It was agreed that both are essential. It was also agreed that additional members be nominated. Names of potential candidates were suggested by members during the meeting and other names will be sent to the secretariat in the near future. In view of the importance of both management and policy in water resource development, a search should be made for high level officials preferably with national or international reputation and standing. The Panel is well aware that candidates of this calibre are very busy individuals but feels that any who could be interested in membership would be of inestimable value to the achievement of the objectives of the Panel.

## 8.3 The next meeting of the Panel

The Panel welcomed the invitations of FAO and UNEP to host the next meeting in the cities of their respective headquarters and was happy to accept the invitation to hold the next meeting in Nairobi. There was general agreement that 14-20 September 1982 was the most suitable of the available time periods in which it could be held.

Following extensive discussion, the Panel approved as the general topic for the technical discussion at the next meeting the subject "Environmental management measures in water resources development projects - their selection, planning, application and operation in different phases of project development".

It was considered that the technical discussion should bear on matters of policy and should aim at reaching conclusions of interest to a wide range of policy makers and senior administrators rather than to a narrowly technical audience. It was also essential to preserve an intersectoral and multidisciplinary approach to the topic. As the subject was a very broad one, it would be necessary to concentrate on certain aspects, and it was thought that management systems merited particular emphasis; among the many types of water resource development, irrigation schemes would provide a suitable focus for discussion.

To ensure that the Panel's discussions at this meeting are effective, it will be desirable to strengthen the financial and economic expertise among the participants, whose number could be increased to between 10 and 12 people if budgetary limitations allowed. As the total membership of the Panel increased, the members invited to meetings would vary from year to year.

The topic suggested and approved for the 1983 technical discussion was the development of forecasting methodology for the health consequences of different types of water resource development projects.

The Panel also considered and approved the proposed agenda for the next meeting as submitted by the secretariat (see Annex III).

## 8.4 Strengthening of the secretariat

It is clear that if the Panel is effectively to undertake even a part of the activities which it considers urgent and necessary the secretariat will have a considerable amount of extra administrative and managerial work. Moreover, if the significance of the Panel's aims is to be brought home to the ministries concerned in the execution of water development projects in their countries, the effort required will be much greater than can be done effectively by part-time activities. The Panel therefore recommended that one full-time professional staff member should be recruited to assist the secretariat and should be provided with appropriate secretarial assistance.

## 8.5 Funding

With regard to the Panel's programme of work for 1981/82, the Panel felt that items (a) through (g) (see section 6 above), at an estimated total cost of US\$ 83 000, should be



financed by the participating organizations through their annual contributions, which should be raised. Item (h), participation in multidisciplinary missions, should be funded from extrabudgetary sources.

When making recommendations for education, training and various field projects, the Panel was well aware that money must be found to support these important, though modest, undertakings. The basic philosophy which emerged after considerable discussion was that, since development projects aimed at improving the standard of living produced both favourable and unfavourable by-products, a hydroelectric project, irrigation, land development or any other land or water resources enterprise which created environmental or health hazards must assume the responsibility for applying remedies.

It was noted that a report prepared by the International Institution for Environment and Development entitled "Banking on the Biosphere" had examined the role of the major development agencies and banks in environmental protection, and that, in general these institutions had pledged themselves to support the principle and recommendations contained in that report. One of these recommendations was for the training of environmental experts in the developing countries. Since more than half of the project proposals that the Panel had approved were for education and training in developing countries, and the remainder were for improving the technology required for environmental management for vector control, it was thought that funding would not present a great difficulty.

There appeared to be some advantage in grouping the projects and selecting certain groups for submission to the various development assistance agencies according to their specific interests. The Panel strongly recommended that individual Panel members should make every effort and use their personal influence to promote interest and support from these agencies for the work of the Panel.

Since several projects of relatively small cost are proposed to be based in the Sudan as part of the ongoing Blue Nile Health Project an approach might be made to the agencies already funding this work with a view to having these projects included in their financing aid programme. Listed below are the recommended projects and the candidate agencies:

(1) <u>Educational Projects</u> (see section 7 above)	US \$
(a) Strengthening of engineering and agricultural educational institutions in environmental management for disease/vector control	15 000
(b) Seminar on prevention and control of health and environmental problems in water resources development projects (to be held in Europe, without field observations)	20 000
(c) Seminar on prevention and control of health and environmental problems in water resources development projects (to be held in Sudan or another developing country, with field observations)	20 000
(e) Preparation of training aids	15 000
(k) Training course in vector ecology and control in development	22 000
	<hr/>
	92 000

Agencies:

- Canadian International Development Agency
- Danish International Development Agency
- Federal Ministry for Economic Cooperation, Federal Republic of Germany
- Swedish International Development Authority
- Direction de la Cooperation au Développement et de l'aide humanitaire, Switzerland
- Agency for International Development, (USA)
- United Nations Childrens Fund (UNICEF)

Project

- (d) Training courses on prevention and control of health and environmental problems in water resources development projects in arid and semi-arid zones
- |                          | US \$                            |
|--------------------------|----------------------------------|
| - Course 1 in Kenya      | 85 000 Government of Kenya       |
| - Course 2 in Mauritania | 100 000 Islamic Development Bank |
| - Course 3 in Paraguay   | 100 000 USAID - PAHO             |
|                          | 285 000                          |

(2) Field demonstrations, studies, planning aids

Project

- |   |   |
|---|---|
| (f) Organization of pilot operations in disease control programmes for incorporating simple environmental management measures | US \$<br>50 000 UNEP - TDR                                      |
| (g) Preparation of guidelines for carrying out health/environmental impact studies  | 12 000 UNEP - TDR   |
| (h) An assessment of the effectiveness and the long-term economy of canal lining for vector control                           | 20 000 USSR - UNDP  |
| (i) Field tests of equipment for environmental management related to vector control   | 55 000  |
| (j) Studies on the socioeconomic impact of environmental management measures  | 40 000 Government of<br>----- Netherlands/World Bank<br>177 000 |

It was thought that funds might also be obtained from those supporting technical cooperation among developing countries (TCDC).

## 9. Recommendations

### 9.1 General

The Panel, recognizing the importance of water-associated diseases and their serious socioeconomic consequences in existing and future water resources development projects, recommended that:

9.1.1 A health opportunity assessment should be carried out:

(a) in existing projects as soon as practicable and in conjunction with improvement/rehabilitation plans wherever these are being contemplated, to introduce remedial measures; and

(b) in each project under planning to incorporate at an early stage environmental management measures for vector control in project design for health safeguards.

9.1.2 A health/environmental component should be included in the organizational structure of each project wherever adverse effects are expected or encountered as a result of the construction and operation of the project.

9.1.3 There should be adequate financing for the health/environmental component within the capital and operational funds of the project.

9.1.4 In order to promote intersectoral collaboration at national, regional and global levels, national coordination boards, collaborating centres and an international reference centre should be established.

9.1.5 Where existing legislation is inadequate to meet the needs for environmental and health protection in development projects, action should be taken to provide the necessary mechanism and resources to supply such support.

9.1.6 As a measure to support national programmes on technical issues concerned with the protection of health in development projects, training, research and field studies should be promoted and carried out at the appropriate national, regional and global levels.

### 9.2 Specific recommendations

9.2.1 The Panel recommended that invitations already extended to UNDP, UNICEF and the World Bank, should be followed up in order to encourage their participation in the Panel and its activities because of their considerable involvement in water resources development.

9.2.2 The Panel reviewed the mechanism and organization necessary to implement the above general recommendations and proposed that the Panel should as soon as possible initiate the following:

(a) Establish an international reference centre to collect, collate and disseminate information on water resources development projects and to assist in studies and research in the field of environmental management for vector control.

(b) Compile an inventory of water resources development projects and agencies involved, prepare bibliographies and issue newsletters relative to environmental management and vector-borne diseases.

(c) Promote action to introduce lectures on health hazards of water resources development and preventive measures in curricula of engineering institutions, organize seminars and training courses, prepare guidelines and training aids, and carry out field studies and research in environmental management for disease vector control.

9.2.3 In order to fulfil the above tasks the Panel recommended that the Secretariat be strengthened with additional staff and funding and that meetings of the Panel Secretariat be held at least twice yearly.

9.2.4 The Panel emphasized that financing is essential to implement its activities and recommendations and noted in this connexion that annual contributions of the participating organizations, forming the regular budget of the Panel, should be increased to cover the programme of work of the Panel. The participating organizations should also make every effort to investigate sources for additional funding outside the regular budget in order to finance projects approved by the Panel.

#### ACKNOWLEDGEMENTS

The Panel of Experts wishes to record its appreciation of the contributions made by the following persons: Dr L. Iarotski, Medical Officer, Schistosomiasis and other Helminthic Infections; Dr V. Ivorra Cano, Programming and Training, Malaria Action Programme; Dr F.S. McCullough, Ecology and Control of Vectors; Dr P. Rosenfield, Special Programme for Research and Training in Tropical Diseases; Dr S. Shubber, Legal Division.

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ANNEX I

PROPOSED PROGRAMME OF WORK FOR THE PANEL OF EXPERTS

(October 1981 - September 1982)

Preamble

In accordance with the arrangements agreed upon by the participating organizations and for the accomplishment of the recommendations and decisions of the Panel's first meeting, the following activities have been identified within the Panel's programme of work for 1981-1982. Many of these activities are routine managerial and administrative functions that should be carried out by the secretariat and for this its present facilities and services need to be strengthened.

It is assumed that the participating organizations will cover the cost of the next annual meeting (\$ 40 000) and that of the Panel (items b-g, \$ 43 000) from annual contributions. Item h, Participation in multidisciplinary missions (\$ 75 000) may need to be funded from extrabudgetary contributions.

(a) Organization of the next Panel meeting in 1982

Budget estimate - It is assumed that the next Panel meeting will be slightly larger than the first meeting (10-12 members). The cost of the meeting, including increase due to inflation is estimated at US\$ 40 000.

(b) Secretariat meetings

Two meetings of the members of the secretariat will be held in 1981/1982 (between the first and the second Panel meetings) to follow up activities relating to implementation of the Panel's decisions and preparation for the Panel's activities for 1982/1983 including the organization of the next Panel meeting. Efforts will be made to include such meetings in the official travel plans of the secretariat members.

(c) Establishment of an international information system

It is proposed that an information system be organized and be managed by a Reference Centre, jointly with the Panel's secretariat, through a network of national water resources development coordination boards (or similar bodies) and a network of national collaborating centres as follows:

(i) National water resources development coordination board<sup>1</sup>

Composition - Representatives from ministries of planning, water resources development, irrigation, agriculture, hydropower, health, etc. A secretariat to prepare board meetings and to follow up implementation of board's decisions.

Functions - To ensure effective intersectoral coordination in water resources development at national level, so that the interests of all sectors concerned, in particular the protection of human health and environment, will be appropriately looked after.

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<sup>1</sup> For the promotion of water supply and sanitation activities during the International Drinking Water Supply and Sanitation Decade (IDWSSD), national action committees and technical support teams have been or are being established in Member States. These committees and/or teams, if their terms of reference could be appropriately expanded, could serve as water resources development coordination boards and carry out the required functions.

Relationship with the international information system - To serve as focal point and source of information regarding water resources development projects in the country, and to be supported with technical information by the international system.

(ii) WHO/FAO/UNEP Reference Centre for Environmental Management

An existing institution carefully selected by the Panel and designated as such. The Centre should establish contact with existing water resources institutions to form a network of national collaborating centres for mutual support. At a later stage, the establishment of water resources institutions in countries where these do not yet exist will be encouraged in order to expand the network.

Functions - Compilation and dissemination of information on water resources development projects as received from national coordination boards; compilation, analysis and dissemination of technical information relating to health, environmental and socioeconomic implications of water resources development and to environmental management; bibliographical services; field research and specific studies as requested by the Panel; other related activities as required.

Activities envisaged for 1981/1982:

- (iii) Promote the establishment of national water resources development coordination boards.<sup>1</sup> Oct. 1981 - Sept. 1982
- (iv) Select several institutes which have the potential to serve as the Reference Centre and conduct preliminary contact with them, leading to the selection of one or two candidate institutes. Oct./Dec. 1981
- (v) Visit to the candidate institute(s) by a member of the secretariat or by a consultant and negotiations leading to the final selection and designation of one as Reference Centre (including signing of an agreement). Jan./June 1982
- (vi) The designated Reference Centre, in consultation with and assisted by the secretariat of the Panel, initiates steps to establish a network on national collaborating centres. June/Sept. 1982

Budget estimate

- |   |  |
|---|--|
| (i) Administrative and managerial work can be handled by the secretariat.                 |  |
| (ii) Short-term consultant 1 m/m or travel cost secretariat to visit candidate institutes | US\$ 5 000                               |
| (iii) Grant to the Reference Centre   | US\$ 5 000                               |
|   | Total US\$ 10 000                        |
|   | Subsequent support US\$ 100 000 per year |

<sup>1</sup> Shortly after the WHO/FAO Memorandum of Understanding was signed in 1978, the WHO Programme Coordinators and the FAO Representatives at country level were sent, through the Regional Offices, copy of the document and were requested to promote establishment of national water resources development coordination boards where this has not already been done. They will be reminded to take follow-up action. Assistance of Resident Representatives of UNDP will be solicited in this effort.

In countries where national action committees and/or technical support teams have already been established for the JDWSSD, the terms of reference of these committees and/or teams could be expanded to also include coordination for water resources development and hence no need for separate boards.

(d) Initiation of an inventory of national, international and bilateral agencies involved in water resources development and of such projects

It is proposed that in 1981/1982 the following actions be taken to initiate the inventory, which will be eventually completed and maintained up-to-date by the Reference Centre once it has been well established:

(i) As much information as possible will be collected by the secretariat on agencies involved in water resources development at national and international levels, and on projects being planned, under construction and in operation. (Assistance of RRs UNDP will be solicited). Oct. 1981/Mar. 1982

(ii) The information collected will be compiled for distribution and for handing over to the Reference Centre. April/Sept. 1982

Budget estimate

(i) Administrative and managerial work can be handled by the secretariat.	
(ii) STC 1 m/m for initiation and organization of the system and for compilation of information collected	US\$ 5 000
Requirements (secretarial, stationery, mailing, etc.)	US\$ 3 000
	US\$ 8 000
Total	US\$ 8 000

(e) Compilation of bibliographies on health aspects of water resources development and environmental management for vector control

The Reference Centre, once established, would be a suitable institution to take charge of the compilation and updating of the bibliographies. In view of the urgent need for these bibliographies, it is proposed that the compilation be initiated by the secretariat of the Panel as soon as possible, with a view to completing a first version in the middle of 1982.

Budget estimate

- (i) STC for 1 m/m to carry out a search of the available literature related to the subjects concerned and to compile the bibliographies US\$ 5 000
- (ii) The necessary support needed by the consultant will be provided by the secretariat without additional expenditure.
- (f) Issuing newsletters

It is proposed that:

(i) The newsletters will be issued quarterly as from October 1981 to announce the proceedings of the Panel's first meeting and its decisions and recommendations.

(ii) The intended readership will be: responsible agencies for water resources development, national disease prevention and control programmes, WHO, FAO, UNEP, UNDP, World Bank, WMO, UNESCO and other interested and concerned international and bilateral agencies headquarters, and regional and field offices; professional associations of civil/irrigation engineers; associations of contractors, etc.

Budget estimate

- (i) Editing and distribution can be handled by the secretariat.

(ii)	Pouch services of WHO and other United Nations agencies will be used as far as possible for distribution; however, some extra expenditures for mailing may be involved	US\$ 1 000
(iii)	Cost of printing is estimated at (for four issues)	US\$ 4 000
	Total	US\$ 5 000

(g) Strengthening of the secretariatBudget estimate

(i)	Contractual, technical and administrative and clerical services	US\$ 10 000
(ii)	Miscellaneous and contingencies	US\$ 5 000
	Total	US\$ 15 000

(h) Participation in multidisciplinary missions

It is important that, as part of the feasibility study for each development project, a health/environmental impact study should be carried out. It is also important that any water resources development project which may have adverse health effects should include a health component.

Several multidisciplinary missions have been organized by UNDP in recent years for the review of water resources development projects. WHO participation in such missions has been passive (i.e., on an "on-request" basis) and limited, due to shortage of staff and funds. It is proposed that:

- (i) An active attitude be taken towards participation in such missions.
- (ii) The Panel should establish contact with international and bilateral funding agencies, drawing their attention to the serious consequences of ignoring health/environmental impact studies and measures, and offer assistance and participation in such missions, to assist in impact studies and environmental management planning.
- (iii) The Panel secretariat and the participating organizations will assist the projects with such studies at the latter's expense.
- (iv) A list of competent experts will be compiled for such studies and proposed to agencies for formation of teams.
- (v) Funds be raised to cover the costs of the Panel's assistance and participation whenever the projects are unable to cover the costs.

Budget estimate

(i)	STC epidemiologist/entomologist 5 m/m	US\$ 25 000
(ii)	STC sanitary engineer 5 m/m	US\$ 25 000
(iii)	STC biologist/environmentalist 5 m/m	US\$ 25 000
	Total	US\$ 75 000



## BUDGET SUMMARY

<u>Item</u>	US\$
(a) Organization of the next Panel meeting	40 000
(b) Secretariat meetings	-
(c) Establishment of an international information system	10 000
(d) Initiation of an inventory of water development agencies and projects	8 000
(e) Compilation of bibliographies	5 000
(f) Issuing newsletters	5 000
(g) Strengthening of the secretariat	15 000
	<hr/>
	Total (Annual contributions)
	83 000
	<hr/> <hr/>
(h) Participation in multidisciplinary missions (Extrabudgetary contributions)	75 000
	<hr/> <hr/>

ANNEX II  
PROJECT PROPOSALS

<u>Project No.</u>	<u>Title</u>	<u>Estimated Cost</u> US \$
(a)	Strengthening of engineering and agricultural educational institutions in environmental management for disease/vector control	15 000
(b)	Seminar on prevention and control of health and environmental problems in water resources development projects (To be held in Europe, without field observations)	20 000
(c)	Seminar on prevention and control of health and environmental problems in water resources development projects (To be held in Sudan or another developing country, with field observations.)	20 000
(d)	Training courses on prevention and control of health and environmental problems in water resources development projects in arid and semi-arid zones	
	Course 1 in Kenya	85 000
	Course 2 in Mauritania	100 000
	Course 3 in Paraguay	100 000
(e)	Preparation of training aids	15 000
(f)	Organization of pilot operations in disease control programmes for incorporating simple environmental management measures	50 000
(g)	Preparation of guidelines for carrying out health/environmental impact studies	12 000
(h)	An assessment of the effectiveness and the long-term economy of canal lining for vector control	20 000
(i)	Field tests of equipment for environmental management related to vector control	55 000
(j)	Studies on the socioeconomic impact of environmental management measures	40 000
(k)	Training course in vector ecology and control in development	22 000

Annex II

Project (a): Strengthening of engineering and agricultural educational institutions in environmental management for disease/vector control

In order to suitably prepare the future engineers and agriculturalists with respect to the protection of human health in developmental undertakings, it is very important that the engineering and agricultural educational institutions be strengthened in the area of environmental management for disease/vector control.

Proposals

- (i) Select one or two interested engineering/agricultural colleges as candidates for being strengthened.
- (ii) Assign a consultant to the selected college(s) to review the existing engineering/agricultural curricula, and to propose additions to the curricula to include: (1) health implications of water resources development and agricultural activities; (2) methodologies for carrying out health/environmental impact studies; (3) environmental management measures for vector control; (4) applications of these measures in water resources development projects; (5) other related subjects.
- (iii) Assign lecturers to lecture on those subjects.
- (iv) Publicize the results and encourage other colleges to make similar additions to their curricula.

Budget estimate

(i) Temporary adviser (TA) or contractual services (CS) for review and amendment of curricula	US\$ 5 000
(ii) TA/CS for preparation of lectures, lecturing and writing-up of the experience	US\$ 10 000
TOTAL	US\$ 15 000

Project (b): Seminar on prevention and control of health and environmental problems in water resources development projects (To be held in Europe, without field observations)

In order to ensure that human health and environment will not suffer unduly from developmental efforts, particularly in the field of water and agricultural development, it is important to promote (1) multidisciplinary/intersectoral communications on health implications of development and environmental management measures for disease vector control, and (2) appropriate amendment to the curricula for engineering studies in universities and other educational institutes to include suitable coverage of the above-mentioned aspects.

A Civil Engineers/Schistosomiasis Working Group was organized by Dr John A. Jewsbury of Liverpool School of Tropical Medicine and two meetings were held in 1979 and 1980. In the 1980 meeting, there were 44 participants of whom 50% were engineers. Approximately 50% of the engineer participants were with consulting engineers. The meeting provided excellent opportunities for engineers, biologists, physician/epidemiologists, sociologists, and economists to exchange views on the role these professions can play in the prevention and control of water-associated vector-borne diseases in water development projects, and it aroused the interest of the participants in health protection. Unfortunately, due to a change of responsibilities of the organizer and the lack of financial support, this group is facing the danger of being terminated.

Proposals - It is proposed to organize a seminar in 1982 or 1983 on the prevention and control of health and environmental problems in water resources development projects, specifically designed for practising engineers, representatives of engineering professional associations and engineering educational institutions, biologists, epidemiologists, sociologists and economists. This seminar will be a continuation of the Civil Engineers/Schistosomiasis Working Group but with an expanded scope to cover other important water-associated vector-borne diseases as well.

It is expected that the seminar will have a duration of about a week and will accommodate 40-50 participants. In addition to WHO, FAO and UNEP, the three participating agencies of the Panel, UNDP, World Bank, regional development banks and other interested international and bilateral agencies will be invited to send observers. Major subjects to be covered will be: (1) water-associated vector-borne diseases; (2) methods for the prevention and control of these diseases, including the integrated control concept and the comprehensive approach; (3) health and environment implications of water resources development projects and the approaches to preventing adverse health effects; (4) multidisciplinary and intersectoral collaboration and the role the individual professions can play in the protection of human health and environment in development undertakings; (5) suggestions for further promotional activities.

Venue of the seminar: Geneva, Rome or another place in Europe.

#### Budget estimate

- (i) Costs for travel and per diem of participants will be borne by their respective employers.
- (ii) Organizational costs are estimated as follows:
- |   |             |
|---|-------------|
| - Temporary advisers                              | US\$ 5 400  |
| - Secretariat                                     | US\$ 4 600  |
| - Cost for conference organization and facilities | US\$ 10 000 |
| TOTAL   | US\$ 20 000 |

Project (c): Seminar on prevention and control of health and environmental problems in water resources development projects (To be held in Sudan or another developing country, with field observations)

#### Proposals

- (i) Time of seminar: 1982 or 1983;
- (ii) Place of seminar: Sudan or another developing country;
- (iii) Participants: 20-25 practising engineers, representatives of engineering, construction and educational institutions, biologists, epidemiologists, sociologists and economists, decision-makers who would like to undertake field observations in an operating project;
- (iv) Duration of seminar: 10 days;
- (v) Major subjects to be covered: same as for Project (b) except that field observations will be included.

#### Budget estimate

- (i) Costs for travel and per diem of participants will be borne by their respective employers.

Annex II

(ii) Organizational costs are estimated as follows:

- Temporary advisers	US\$ 7 000
- Secretariat	US\$ 5 600
- Cost for conference organization and facilities	US\$ 7 400
	US\$ 20 000
TOTAL	US\$ 20 000

Project (d): Training courses on prevention and control of health and environmental problems in water resources development projects in arid and semi-arid zones

Proposals - It is proposed to hold a series of three courses on water management for vector control in arid and semi-arid zones, provisionally in Sudan (1982 or 1983), Mauritania (1983 or 1984) and Paraguay (1984 or 1985). Each seminar will accommodate 20 participants to be nominated from health, agriculture and water resources sectors and decision-makers in six to seven countries in arid or semi-arid zones. In addition to WHO, FAO and UNEP, UNDP, World Bank, regional development banks and other interested international and bilateral agencies will be invited to send observers. Duration of each seminar will be two weeks.

Major subject to be covered will be: (1) water-associated vector-borne diseases; (2) socioeconomic development of arid and semi-arid zones and its relationship with water and agricultural development; (3) health aspects of water and agricultural development; (4) environmental considerations in water and agricultural development, environmental or health impact studies; (5) environmental management methods for vector control, other methods for vector control, integrated vector control, and the comprehensive approach; (6) planning environmental management for vector control, planning land and water resources development projects, planning community development projects by local participation, intersectoral collaboration; (7) case study.

Budget estimate

(i) Course 1 in Kenya (in English)	US\$ 85 000
(ii) Course 2 in Mauritania (in French)	US\$ 100 000
(iii) Course 3 in Paraguay (in Spanish)	US\$ 100 000

As the seminars are intended for participants from developing countries, the above estimates include travel and per diem costs for the participants.

Project (e): Preparation of training aids

The need for training aids has been badly felt in recent years in conducting seminars on prevention and control of water-associated vector-borne diseases in water resources development projects and in training courses on disease control including discussions on environmental management for vector control in the context of integrated control. The preparation of training aids was recommended by the WHO Expert Committee on Vector Biology and Control in its fourth report "Environmental Management for Vector Control", WHO Technical Report Series No. 649, 1980 (Recommendation 6 (h)).

Proposals

- (i) Prepare film strips or slides showing: (1) the preferred habitats of vector mosquitos and host snails; (2) the various environmental management methods for vector control, such as: filling, drainage, deepening and filling, aquatic weed control, stream

flushing, etc.; (3) the various irrigation methods and canal systems; (4) the poorly maintained irrigation canals and drainage ditches; (5) the canal maintenance machineries and the cleaning process; (6) other related topics. 60-100 slides.

- (ii) Prepare transparencies for overhead projectors, to be used in lectures on environmental management for vector control. Tables, charts, diagrams, etc., total 20.
- (iii) A motion picture will be made of the various operations of the Blue Nile Health Project in the Sudan by a German film company. Copies of this film can be used as a training aid in pertinent seminars and courses.
- (iv) Make available these training aids on loan basis to seminar/course organizers.

Budget estimate

(i) Photographing of film strips or slides by contract and reproduction (10 copies)	US\$ 5 000
(ii) Preparation of transparencies (10 copies)	US\$ 3 000
(iii) Purchase of the movie film of the BNHP (3 copies)	US\$ 7 000
TOTAL	US\$ 15 000

Project (f): Organization of pilot operations in disease control programmes for incorporating simple environmental management measures

One of the recommendations of the WHO Expert Committee is the integration, without delay, of appropriate, simple and inexpensive environmental management methodologies for vector control into large-scale vector-borne disease control programmes as well as into primary health care systems (Recommendation 5 (f), fourth report of the WHO Expert Committee on Vector Biology and Control, entitled "Environmental Management for Vector Control", WHO Technical Report Series No. 649, 1980). The most practical approach for the integration, according to the Expert Committee, is to begin with the training of staff, the organization of pilot operations where the feasibility and cost/effectiveness of local application of these measures will be tested, and then the reorientation of the national services towards an integrated use of environmental management measures.

As a follow-up to this recommendation, the Director of Vector Biology and Control of WHO wrote to all WHO regional directors on 26 January 1981, suggesting that one or two countries with organized malaria control programmes be selected from each region, in which a study is to be conducted on (1) the manpower needs and the possible arrangements for training, (2) the possible sites for pilot operations and the general framework for such operations, and (3) the organizational reorientation required and the steps to effect this reorientation at the National Malaria Service. Response from the regions has been positive, but the major constraint is inadequate funds (1) to sponsor the proposed studies in selected countries, and (2) to supplement the costs of pilot operations.

Proposals - In view of the importance of this activity and in order to spur up its implementation, it is suggested that the Panel considers the possibility of raising funds from outside sources to support the study missions and also the pilot operations (in countries which cannot bear the total costs from available national resources) for a period of three years.

Budget estimate

- (i) Costs for participation in reconnaissance and study missions either by STC or by existing staff of WHO headquarters or regional offices (Estimated on basis of STC 3 m/m each year) US\$ 15 000 per year (for 3 years)

Annex II

- (ii) Supplement to costs for pilot operations in countries where the available national resources will not be able to cover the total amount:

Estimated target	US\$ 35 000 per year (for 3 years)
TOTAL	<u>US\$ 150 000</u>

Project (g): Preparation of guidelines for carrying out health/environmental impact studies

Although books and references on health/environmental impact studies, particularly on environmental impact studies, are available, simple guidelines suitable for use by epidemiologists and sanitary engineers who have no previous experience in this type of work are still needed. The guidelines should be practical, containing step-by-step procedures as well as illustrative examples.

Proposals

- (i) Review available publications on health/environmental impact studies by consultant.
- (ii) Write up guidelines by consultant (approximately 20 pages).
- (iii) Publish the guidelines and make them available to epidemiologists, sanitary engineers and allied professionals who are entrusted with the responsibility of carrying out such studies.
- (iv) Translation of the guidelines into French and Spanish may be necessary and this will be considered at a later date.

Budget estimate

(i) CS or TA for review of available literature and for write-up. 1 m/m	US\$ 5 000
(ii) Editing and printing (500 copies)	US\$ 7 000
TOTAL	<u>US\$ 12 000</u>

Project (h): An assessment of the effectiveness and the long-term economy of canal lining for vector control

Canal lining can be an important environmental management measure for vector control, but its use has been limited because of its allegedly high capital cost. However, in the long-term it may prove more economical than other methods. It is therefore necessary to assess the effectiveness and the long-term economy of canal lining for vector control. Also, canal lining has many technical advantages, such as: increased smoothness, reduced leakage and seepage (thus requiring a smaller cross-sectional area than an unlined canal for irrigating a given acreage of land, and also lesser rights-of-way), and reduced maintenance requirements. Lining may be economically justified on these technical grounds; a careful study on this is necessary.

Proposals

- (i) Collect and analyse information on capital maintenance costs, service life and effectiveness for vector control of different types of canal lining from different areas and situations.

- (ii) Organize and conduct studies on the effectiveness of different types of canal lining against disease vectors, to supplement the available information.
- (iii) Estimate the cost of similar control achieved through other methods of vector control if the canals were not lined.
- (iv) Assess the long-term economy of comparable lined and unlined canals for the same degree of vector control.
- (v) Also compare the long-term economy of lined canals versus the unlined, based on the technical (or engineering) benefits of the former.
- (vi) Publish the results of the study, together with conclusions and recommendations.

Budget estimate

(i) Collection of information by the Secretariat	
(ii) CS/TA for compilation and analysis of information collected and for design and organization of field studies as required	US\$ 5 000
(iii) Grant or supplementary payment to the institute (or the programme) undertaking the field studies	US\$ 10 000
(iv) Final analysis of results and writing-up	US\$ 5 000
TOTAL	US\$ 20 000

Project (i): Field tests of equipment for environmental management related to vector control

Environmental management for vector control is, at present, being applied on a small scale. Experience with equipment for this type of work is rather limited in disease control programmes and water resources development projects. If this type of work is to be promoted and extended, it is necessary to expand the use of simple, inexpensive and versatile equipment, capable of accomplishing several tasks, such as: excavation, levelling and grading, earth-moving, ditch digging, vegetation clearing, etc. Field tests and experimental use of several types of such equipment are necessary to provide local durability and costs data, based on which selection can be made.

Proposals

- (i) Based on the existing experience of simple, inexpensive earth-moving and ditching equipment (manual, animal drawn, and powered), select several types which seem to have good prospects for environmental management work, for field tests.
- (ii) In cooperation with an operational disease/vector control programme, organize and conduct field tests and experimental use of the selected equipment.
- (iii) Prepare a report at the end of the field tests, summarizing the results of the field tests and providing guidelines for the appropriate selection.



Annex IIBudget estimate

(i)	Purchase of equipment and spare parts <sup>1</sup>	US\$ 40 000
(ii)	Operational costs during the field test, including subsidies to the national officer responsible for the test	US\$ 10 000
(iii)	STC or secretariat 1 m/m for evaluation of test results and report writing	US\$ 5 000
	TOTAL	US\$ 55 000

Project (j): Studies on the socioeconomic impact of environmental management measures

Previous studies on this subject have been rather scanty, fragmentary and inconclusive. Comprehensive studies are needed in order to confirm the socioeconomic justifications for health protection in water resources development projects.

Proposals

- (i) Select a suitable area in a water resources development project which has a strong health component as the site for the study. The Blue Nile Health Project in the Sudan would seem to be a good candidate study site.
- (ii) Design the study project and prepare the study protocol, including the selection of socioeconomic indicators as bases for evaluation.
- (iii) Monitor, as per the protocol, the application of environmental management measures; their direct benefits such as increased agricultural production, reduced water requirement, etc.; the trend of vector and disease reduction; and the up-grading of socioeconomic conditions. Several years' observations may be required to obtain meaningful results.
- (iv) Analyse the results obtained and write up a report for publication.

Budget estimate

(i)	Contractual services or temporary adviser for selection of project site, design of project and preparation of study protocol	US\$ 5 000
(ii)	Grant or supplementary payment to the selected water resources development project for carrying out the study activities	US\$ 25 000
(iii)	Contractual services or temporary advisers for annual evaluation and analysis of results and writing up a report	US\$ 5 000
(iv)	Miscellaneous	US\$ 5 000
	TOTAL	US\$ 40 000

Project (k): Training course in vector ecology and control in development

Recent initiatives, such as the Schistosomiasis Working Group and the Blue Nile Health Project, have revealed the interest of many planners, designers, constructors and operators

<sup>1</sup> It is assumed that most of the selected types of equipment to be tested are already available with the disease control programme where the field tests are to be carried out. This amount is provided for the purchase of the one or two types of equipment which are not available.

of various land and water development projects in improving their knowledge and capabilities in assessing and countering the risks to health often associated with such projects through the spread of vector-borne diseases.

Following preliminary discussions with WHO, UNEP, London School of Hygiene and Tropical Medicine, Liverpool School of Tropical Medicine and the Edna McConnell Clark Foundation questionnaires were distributed by FAO internally, through the United Nations system and associated organizations and institutions. These have since been replicated by the commercial press and replies continue to be received, although the initial deadline is now past.

The response, based on an analysis of the first batch of replies confirms that there is sufficient demand to justify the preparation of a course in vector ecology and control in development for executive, managerial and academic staff with responsibility for agricultural, land and water resources development. Particular areas of concern include relevant civil engineering activities, irrigation, drainage and rural development. The duration of the course considered most suitable by some 50% of respondents is four weeks. A number of replies suggested up to three months, and others indicating one or two weeks' duration confirm the existence of interest in short seminars also proposed among the projects for consideration by the Panel.

#### Proposal

(i) Select a university college or department with the necessary expertise in tropical medicine and community health, including wide field experience in the study of the major vector-borne diseases in rural areas and in agricultural and water development projects. The institution should have ready access to the services of teaching staff in engineering disciplines, agriculture and economics.

Essential facilities include classrooms, laboratories, appropriate equipment and teaching aids and adequate accommodation for up to 25 students for a course not exceeding one month.

(ii) Establish a task force consisting of staff and associate lecturers from the selected college or department together with representatives of WHO, FAO and UNEP, to prepare a curriculum for the course, and the necessary administrative and support arrangements for holding it during the late summer of 1982.

Suggested subjects for the course would include the biology of major disease vectors and intermediate hosts; mechanisms for disease transmission; habitats and environments suited to their breeding; the impact on vector production of environmental changes associated with the development of natural resources, particularly land and water; preventive and corrective measures and their effectiveness (medical, chemical, social, structural, environmental modification and manipulation); the effects of vector control measures on production in development projects; the economics of vector control.

(iii) Approach institutions, organizations and individuals already expressing interest in participating in a course of this type, duration and timing, to obtain a confirmed minimum of about 20 students, and further publicize the proposed course to assess the desirability of its repetition or possibly replication in other locations by the same or additional institutions. By 31 August 1981, four institutions had expressed interest in hosting a course of this type.

Annex II

Budget estimate

(i) Staff or consultant time, travel and per diem of preparatory task force to be borne by the participating organizations and university.

(ii) Organizational costs

Lecturers	US\$ 15 000
Training equipment, materials, classrooms and laboratories	US\$ 5 000
Field trips and other local costs	US\$ 2 000
	<hr/>
	US\$ 22 000
	<hr/>

(iii) Costs for travel and per diem of participants to be borne by the individual, the employer or by a sponsoring organization.

ANNEX III

SECOND MEETING OF THE JOINT WHO/FAO/UNEP PANEL OF EXPERTS  
ON ENVIRONMENTAL MANAGEMENT FOR VECTOR CONTROL

Proposed agenda

1. Opening of the meeting
2. Election of officers
3. Adoption of the agenda
4. Review of the annual report on the work of the Panel in 1981/82 - An analysis of achievements and constraints
5. Review of the Panel's approaches to promoting environmental management
6. Proposed programme of work for the Panel of Experts, 1982/1983
7. Project proposals
8. Policy matters
9. Technical discussion
10. Date and venue of next meeting
11. Other business
12. Adoption of report
13. Closure of meeting

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## ANNEX IV

## TECHNICAL DISCUSSION

Environmental Management for Vector Control in Rice Fields1. Introduction

Rice is one of the most important crops in the world, particularly in Asia where it is the staple diet of more than 60% of the population. Its importance is increasing as rice production spreads to areas in Africa and it is expected that production should be increased by some 200 million tons for the developing countries by the year 2000. Because of the extensive areas of land which are inundated for rice cultivation, the Panel considered that it should give particular attention to the present and potential problems of water-associated diseases which may be connected with these conditions.

2. Agricultural Issues

Rice is a unique food crop in that it is adapted to grow in flooded soils and under a wide range of environmental conditions.

In Asia average rice yields are high, at around 2.38 T/ha. Extensive use is made of new high yielding varieties, which respond well to fertilizers, and the application of herbicides and pesticides. Further increases in yield are being made by the expansion and improvement of irrigation systems or by introducing improved water management practices.

In Africa, where the area devoted to rice cultivation is on the increase, yields are very low - around 1 T/ha. More than 50% of present land cultivated is used for upland rice and produces only 20% of the total rice production. If production is to be improved, there must inevitably be a move towards flooded rice and to the introduction of strategies which will increase the yield/ha. This must first involve improved water régime which will assist in stabilizing yields, and then the introduction of a package of improved varieties, fertilizers and pest control measures, etc., to increase them. Farmers in developing countries generally cannot afford modern technology and therefore seldom apply the entire package. The cost of introducing measures to control water-associated diseases must also be considered as an addition to this package.

The Panel discussed many of the complexities of rice growing. Agricultural issues concerned with soil-plant-water relationships, the paddy ecosystem in the nitrogen economy and the role of micro-organisms in relation to crop production were discussed. The importance of water management practices was also examined at length as this is a key issue to increasing yields. The detailed practices of continuous or intermittent irrigation were discussed later; comments here centred around more general management issues. There was obvious concern about acute shortage of trained manpower in the developing countries who could adequately cope with improved agricultural practices. Farmers too may be reluctant to change from a well tried practice to something new. They are also reluctant to put in other expensive inputs when they lack confidence in the assurance and reliability of a water supply system.

Clearly the issues surrounding increased rice production are varied and complex and are dependent on geographical, ecological and socioeconomic conditions. The future of rice production depends on the development and improvement of lowland rice areas, with the adoption of new technologies. This may well bring new disease risks along with it and must now be examined.

The Panel was informed that FAO is currently preparing a document in the series of Irrigation and Drainage Papers, entitled "Water Management in Paddy Fields", and requested that copies of the publication be provided to the Panel members and the participating organizations.

### 3. Health Issues

The deliberations, which covered the major aspects of the triumvirate of food, public health and environment, were focused on rice and water management. Paradoxically, growing rice, which is the staple food of half of the human race, can result in human suffering and debilitation. Most rice grows well when the soil is saturated with water. Rice fields are often impoundments with rice plants intersecting the water surface, providing the environmental niche required for vector mosquito larvae or for the snail intermediate host of schistosomiasis.

In this regard, some malaria vectors, such as An. sinensis in the flat lands of China, prefer the rice paddy as their breeding habitat. Thus, irrigated rice cultivation has accounted for the epidemic spread of malaria in certain countries. Some major vectors of encephalitis, such as Culex tritaeniorhynchus in East Asia and parts of South-East Asia, share the habitat of the rice paddy with anopheline vectors. Furthermore, several important vectors of Malayan filariasis also breed in the rice fields. So the rice fields are closely associated with at least two other major groups of vector-borne diseases, in addition to malaria and schistosomiasis. Depending upon the cultivation practice the latter disease may be more associated with the channels and the drains than the rice paddy. Geographical, climatic and cultural differences, as well as cultivation practices, whether manual or mechanical, all must be thoroughly dealt with in order to evaluate the nature of the hazards.

The concern of the Panel is that too broad a treatment of the problem of rice cultivation may be self-defeating. It was proposed that initial efforts be directed to schemes with a level of water management and control which enables the introduction and application of health safeguard measures. This delimits the problem to more manageable terms but in no way ultimately eliminates the problem of the small rice farmer wherever he may be.

### 4. Potential Methods of Prevention and Control

A number of factors must be considered for health protection in areas which have been identified as having disease problems associated with rice production. In respect of water-associated diseases, the first step is to define the severity of the problem in terms of proximity of vector sources to the human habitations, the severity of vector production, and the distribution of vector production between the rice fields and sources outside the fields such as canals, ponds and farm ditches. Once the sources have been identified and their severity determined, methods of vector control must be considered.

Water is the primary element responsible for disease transmission associated with rice fields. This means that water management offers one of the best opportunities for reducing vector production. Some rice fields will remain flooded almost continuously for lack of good irrigation and drainage facilities, or for a number of advantages attributed to continuous flooding. Some of these advantages are weed control, saving in water management labour, nitrogen fixation by algae, and maintenance of relatively stable soil temperature. Vector control in these fields may have to be accomplished by means other than water management. There are, however, many situations where irrigation and drainage facilities will allow intermittent irrigation of the rice crop. Drying of the soil surface between irrigation applications can eliminate mosquito larvae and reduce snail population. Intermittent irrigation is now being practised in many areas for the purpose of saving water and correction of soil problems created by continuous flooding. Vector production has been greatly reduced in these fields. Extension of intermittent irrigation to replace continuously flooded rice, where this is desirable, will require development of rice varieties adapted to intermittent irrigation, improvement of irrigation and drainage systems, improvement of system management, and development of methods for convincing farmers that they should practise intermittent irrigation in those situations where this is feasible.

Annex IV

Chemical pesticides have been used to render the immediate environment of disease vectors either repellent or lethal. Vector resistance to pesticides, and human resistance to their application, have made this form of environmental modification difficult and expensive. Nevertheless, intelligent selection and application of chemicals, in such fashion as to avoid damage to non-target environmental elements, will continue to be necessary in situations where other forms of vector control are not applicable. The need for chemical control will decrease as non-chemical environmental control methods are developed and adopted.

Vegetation manipulation to reduce vector breeding associated with rice fields is related to weed control in irrigation and drainage channels as well as within the fields themselves. Weed control in upland or intermittently irrigated rice will continue to require the use of some chemicals combined with properly timed mowing and tillage, plus alternative cropping when this is feasible. Weed control in flooded fields and channels can often be accomplished by the use of fish such as grass carp and tilapia.

Biological control methods could be promising in the control of disease vectors associated with rice fields. A number of predatory fish species are being used successfully to control mosquito breeding in many places. There is also the possibility of identifying indigenous fish species with high larvivorous potential. Thus, there is much scope for the use of larvivorous fish alone or in an integrated control programme against vector breeding in rice fields. A bacillus, Bacillus thuringiensis serotype H-14, has been found to be effective against mosquito larvae, highly host-specific and safe to non-target organisms. It is on the verge of commercial production and could be an effective biological control agent against rice field breeding mosquitos. Insect growth regulators that disrupt the development of mosquito larvae, and of pre-imaginal stages of some insect pests of rice have proven promising in field trials. Some are already commercially available. They can be applied in the same manner as chemical pesticides but should be harmless to non-target organisms. Parasitic nematodes, protozoans and fungi have been developed to control some agricultural pests and could have a potential for the control of mosquitos and snails. It would appear that increased attention to biological control agents could reduce the need for chemical pesticides in the control of disease vectors associated with rice fields.

#### 5. Applicability of Methods to Specific Circumstances for Rice Production

At several stages in the Panel's discussion of environmental management techniques for vector control, it was stressed that current scientific knowledge upon which the technique is based is relatively sparse. The intervention of the chemical control measures applied soon after World War II all but terminated the development and application of management schemes for vector control. Documentation of such practices for rice cultivation is limited and quite old. Many projects were reported in areas of the world where malaria and schistosomiasis no longer or never did exist. Further, these experiments must be considered with regard to the quality of the data and interpretation of the results. The most difficult is the transfer of these ideas to other parts of the world. The Panel feels that the first task is to use the best judgement in this matter and to proceed promptly with the most favourable management techniques that have had historically proven results.

#### 6. Future Programmes and Plans of Action

Several courses of action are proposed:

- (i) There is a need to establish globally and nationally the extent of the vector problem in rice irrigation developments. Rice irrigation per se does not necessarily imply a vector problem.
- (ii) Once problem areas are identified then research programmes can be established and trials undertaken to examine the effectiveness of various control measures, including water management.

(iii) Education and training programmes need to be established at all levels within rice projects in order to introduce successfully new control measures.

Whilst there is a need for such action in many areas of the world, the Panel felt that emphasis should be placed on the African countries. Here rice is in its infancy and so this is an area where the greatest impact could be made.

#### 7. Collaboration with Other Institutions and Agencies

In order to implement the plan of action it will be essential to work through existing institutions and agencies. These include: UNDP, IRRI, WARDA, ICID, AIT, Asian Development Bank.

Approaches can also be made to universities and schools of public health and tropical medicine.

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