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Environmental Health Impact Assessment

Report on a WHO Seminar

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2--6 October 1978

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WHO SEMINAR ON ENVIRONMENTAL HEALTH IMPACT ASSESSMENT

Argostoli, Kefalonia, Greece, 2-6 October 1978

The Seminar on Environmental Health Impact Assessment, held in Argostoli from 2 to 6 October 1978, examined in detail the process of environmental impact assessment, isolated the health component and considered how it should be incorporated in the overall process.

The purpose of the Seminar was to review, on the basis of a number of case studies, the experience gained by various countries in assessing the environmental health impact of economic development, and to place this experience at the disposal of the Greek Government and other governments; further, to outline a plan of action leading to the development of a model code of practice with regard to the health component of the environmental impact analysis process.

This report contains the main deliberations, conclusions and recommendations of the Seminar.

It is hoped that the recommendations presented here will promote the technique of environmental health impact assessment in countries where this is not practised and, in those countries where the wider process of environmental impact assessment is already operative, substantially improve the human health component of the process.

1. INTRODUCTION

Environmental impact assessment is becoming one of the most powerful tools in the planning of developments, strategies or policies which have environmental consequences.

Recognizing the importance of the environmental impact assessment process and acknowledging that in many cases inadequate attention has been paid to the human health component, the managers of the project on Environmental Pollution Control, Metropolitan Area of Athens, convened this Seminar on Environmental Health Impact Assessment. The Athens project is a joint venture of the Greek Government, the United Nations Development Programme and the World Health Organization.

Dr A. Gilad, WHO Senior Technical Adviser in Athens, served as technical coordinator and Secretary of the meeting. Professor R. Nicoll acted as the Rapporteur.

Speaking on behalf of Dr S. Marketos, Secretary-General of the Ministry of Social Services, Professor G. Markantonatos conveyed the greetings of the Greek Government to the participants. (For list of participants see Annex II.) Mr H. Kamberg, Resident Representative, United Nations Development Programme, welcomed the participants on behalf of UNDP. Both referred to the growing importance of understanding the relationship between environment and development and the integration of environmental considerations, particularly human health aspects, in development planning.

Dr Gilad reviewed the general context of the Seminar and outlined the range of problems to be considered. The experience of developed countries, he emphasized, had shown that the single-minded pursuit of economic development was self-defeating because, by disregarding the other components of what was commonly called "the quality of life", it created conditions which were not acceptable to the general population. Noting that one of the most important ingredients of the "quality of life" was environmental quality, he went on to illustrate the importance of the environmental impact assessment process as a tool for analysing the likely environmental consequences of developments, and the vital role of the human health component within that process.

There seemed to be a distinct correlation between the degree of economic development on the one hand and the type of prevalent environmental health effects on the other, the trend being that, as economic development increased, so the relative importance of the various environmental health effects changed: the problems of prevention and control of communicable diseases became less common and more manageable, while those connected with toxic, carcinogenic and mutagenic materials in the environment assumed an ever-increasing importance.

Dr M. Violaki-Paraskeva, Honorary Director-General, Ministry of Social Services of Greece, accepted the unanimous invitation of the meeting to act as Chairman and Mr M. Giacobino, Ministry of Culture and the Environment, France, and Professor F.M. El-Sharkawi, University of Alexandria, similarly agreed to act as Vice-Chairmen.

The subjects discussed by the participants fell into two main groups:

- (a) technical papers relating to a wide range of environmental health aspects within the total process of environmental impact assessment;
- (b) case studies of major projects in various countries, from which lessons relevant to these processes could be learnt.

The discussion papers and their authors are listed in Annex I.

The conclusions reached in respect of the case studies discussed are presented at the end of each case study report, while the general conclusions and recommendations of the Seminar are grouped together in section 5 of this report.

The keynote address was delivered by Dr R.J.H. Kruisinga, adviser to WHO on environmental health policies, the subject being "A new international health order".

In this new international health order the highest attainable standard of health should be a common goal, to be achieved by means of the benefits of knowledge in the twin fields of human health and environmental protection.

A healthy environment is an essential prerequisite of healthy development. The aim should be to create an environment conducive to physical, mental and social wellbeing, yet surprisingly little money and effort is spent on research in the field of the interrelationship of health and the environment.

Questions have to be answered such as: What is the total human burden? How does one environmental factor influence the damage done to health by other environmental factors? What is the dose-response relationship?

The preventive approach in the field of environmental health is the most efficient. Preventive measures do not impede economic progress but contribute to sound economic development by removing the damaging and negative effects of growth caused in many cases by this economic growth itself.

Social goals can only be realized and economic development brought about by political decisions; those responsible for the human health component must therefore become health politicians, ensuring that environmental considerations are properly taken into account by those responsible for socio-economic decision-making. Environmental impact assessment is an appropriate tool for this purpose.

2. PLENARY SESSIONS

2.1 Background and objectives of environmental impact assessment

This paper outlines the history of environmental legislation in France, the aim of which is to protect the environment and minimize the adverse effects of economic development on man, flora and fauna.

The need to protect agriculture, water catchment areas and fishing, to conserve natural resources, to protect highly scenic areas and to care for buildings of historic or architectural value leads to a synthesis of all impacts being formed so as to produce a global view of the effects upon the environment.

The paper lists the various situations, ranging from land use plans to development projects, in which environmental impact assessment (EIA) is now considered appropriate in France. Emphasis is placed upon the need to take into account existing legislation and procedures, which should not be duplicated or eroded by the introduction of EIA procedures. It is therefore necessary to be flexible and use the EIA tool where and when it can assist most in political decision-making.

In the discussion it was revealed that in France there are four basic requirements which apply to the preparation of an EIA:

- (a) it should describe the condition of the environment before a project is undertaken;
- (b) it should describe the likely effects of the project upon that environment;
- (c) it should explain why this is the preferred option;
- (d) it should explain the measures which are proposed to compensate for or reduce negative effects.

Each EIA is tailored to the circumstances surrounding the project being evaluated, with the aim of isolating real problems and not submerging these in a welter of studies.

The law requiring EIAs to be prepared has only been operative since 1 January 1978 and it is therefore too early yet to say how effective these new requirements will be. EIA may be performed either by a public body or by a private undertaking.

Public participation already has a place in French planning procedures and the EIA process only supplements the existing machinery in this field.

The introduction of new chemicals, pesticides, insecticides, etc., is controlled by the Ministry of Health under other procedures and is not specifically the subject of EIA.

2.2 Overview of environmental impact assessment in various countries

The concept of environmental impact assessment has been used extensively in many countries to assist in national land use management and in the planning of new development projects.

The wide acceptance of EIA techniques stems from its usefulness in assisting existing environmental legislation, since legislation alone cannot deal with conflicts in hypothetical situations or compare alternative solutions. It is necessary to foresee conflicts and try to avoid them before they occur, and EIA is a useful tool for this purpose.

The problem of systematically assessing the impact of a proposed project on the physical and natural environment has been well recognized by national authorities in several countries which have established formal procedures for preparing, reviewing and approving statements of environmental impact. These procedures can be classified in different categories according to the type of projects (public or private, federal or state), the degree of centrality of the responsible agency (federal, state or local), the type of agency structure

(public agency, council with elected or appointed members), the degree of impact coverage (economic and environmental or environmental only), and so on.

In this paper, systems of environmental impact assessment procedures in a number of countries and in various states in the USA are examined and then grouped in categories according to common key characteristics. Special reference is made to the issue of health impact and the various procedures adopted to handle this by different governmental units. Finally, an evaluation of several national assessment procedures has been attempted and their applicability to the Greek governmental structure is examined.

In the discussion it was emphasized that the US model did not find favour in Europe because it was too rigid, complicated and legalistic a system.

The EIA should embrace socioeconomic, as well as environmental impacts but the health component has so far seldom been explicit, perhaps because of the time-lag between the generation of the impact upon people and the emergence of the health problem, and also because of difficulties in quantifying the impacts.

Another problem which militates against the involvement of health authorities in the EIA process is that they are usually separate from the department dealing with economic and physical planning.

A further aspect of the health component which is causing difficulties is the quantification not only of health risks themselves but of the acceptability of those risks by the public at large.

Finally, it is being increasingly recognized that postdevelopment monitoring of the environment, including the human health component, has much to offer in the way of improving knowledge of impacts and perfecting techniques.

2.3 Health effects of environmental impacts

The paper is particularly concerned with assessing the impact of chemicals on human health. According to some recent estimates, about 60 000 chemicals are frequently used in daily life; these include agricultural chemicals, drugs and public health chemicals, food additives, industrial chemicals and consumer products. Chemicals may also appear in the environment as air, water and food pollutants. This number increases at the rate of some 200–1000 new chemicals per year.

Assessment of the impact of chemicals on human health involves identification and evaluation of human health effects associated with exposure to chemicals, both in the occupational and the general environment, with the aim of estimating risks and hazards as a basis for regulatory decision-making and the formulation and implementation of environmental health programmes.

After defining the concepts of risk and hazard, currently used methods for their assessment are discussed, and the advantages and limitations of toxicological and epidemiological approaches are highlighted.

Risk assessment refers to the process by which toxicological or epidemiological studies are reviewed to determine whether or not a chemical may cause specific or nonspecific adverse health effects and, if so, at what levels and with what probability.

In addition to considering the environmental health impact of individual chemicals, there is practical need to assess the health impact of specific technologies and industries; this is illustrated by the example of the synthetic organic chemical industry. Decision-makers involved in the regulatory control of chemicals also need an assessment of the impact of chemicals or technological processes on non-human targets, i.e., animals, plants and materials.

Environmental health impact assessment (EHIA) involves evaluating the benefits derived from the use of a particular product, and the costs associated with the use and disposal of chemicals. The evaluation of benefits and costs requires a multidisciplinary approach and the collaboration of environmental health experts of various kinds with technologists, ecologists and economists.

In the discussion, many problems were revealed regarding dose-response relationships, problems which often result from having only a limited population to study and from other difficulties in designing and executing epidemiological investigations, particularly in the nuclear field. It is significant that, considering the remarkably rapid growth of the nuclear industry, few adverse health effects have been noted so far.

The three basic components of such studies are risk assessment, benefit assessment and acceptability of risk, but in presenting the results of such studies to decision-makers and the public at large it is important to distinguish between established facts and judgements.

2.4 The role of health agencies

The structure of health administration varies from country to country according to environmental health conditions as well as to national differences in social and political systems. Problems of where best to locate the EHIA can only be decided within a given context. However, since EHIA is built in many cases on existing administrative systems, for instance on licensing, planning, etc., it should be integrated with the operations of existing health agencies at national, regional and local levels.

In establishing a procedure, it is necessary to consider where to place the responsibility for impact analyses. As the object of the EHIA is to identify, evaluate and, if necessary, modify projects which could result in significant environmental disruption, responsibility must be given to the health authorities at every administrative level. Both large-scale projects and general

policies must be considered by the national health authority. For the sake of simplicity and practicability, their process must be accomplished through a sequence of screening steps designed to eliminate projects with little or no significant environmental health impact and retain those in need of in-depth study and analyses. Much of the responsibility must lie with the local and regional authorities as well as with the proponent (applicant for building permit, etc.).

Land and water use planning is an important tool of administration. National health authorities are responsible for general environmental health criteria, e.g., water and air quality standards. Regional health authorities apply these standards to the environmental conditions applicable to their region. Local health authorities consider applications in detail and within the national/regional guidelines for specific projects.

In many countries the control of chemicals is in the hands of a specialist government body charged with the duty of considering the effects and effectiveness of various substances. This body, which may comprise specialists from agriculture, industry, science, toxicology, health, etc., considers and recommends the approval of specific substances together with necessary instructions for their use. Thus the basic work is undertaken by specialist bodies but the final decision rests with the relevant administrative body.

The purpose of EIA is to provide a sound basis for the approval of policies and ultimately to aid the decision-maker in his choice. The final decision should be a political responsibility. Furthermore, the purpose of the assessment is to provide the authority with information about the likely consequences of a decision, not to indicate which course should be taken, because he must also take into account and resolve conflicting advice in this and many other fields.

Within the machinery appropriate for any given country, there should be a health agency responsible at all levels of government for all aspects of human health, including environmental health.

2.5 Participation of the public in the EIA process

The paper examines the situation with regard to public participation, with special reference to the planning process and, within that process, to the role of public participation procedures in environmental health impact assessment.

The reason for the narrower role of public participation in planning is that planning procedures have developed in a professional context. Lacking a good theoretical base, measures for public participation have often been inadequate and unsuccessful. Since EIA will normally be carried out within planning processes, these defects must be taken into consideration.

The application of techniques for public participation in the planning process, while often imaginative, has tended merely to heighten the

confrontational nature of the process or to make manipulation of the public easier. There are exceptions, however, and recent moves in some countries suggest that the role of public participation is being seen more clearly.

The practice of public participation in the planning process to date indicates that certain specific considerations such as the level of participation and the nature of representation are important, and that due consideration should be given to these when methods of public participation in EIA are adopted.

Local practices and circumstances will to a certain extent determine how and when the public should be involved, but the following stages are usually appropriate whenever an EIA is being prepared:

- (a) advertisement of the proposal,
- (b) invitation of comments and determination of relevant issues,
- (c) preparation of EIA and consideration of alternatives,
- (d) EIA report,
- (e) EIA evaluation,
- (f) consultation on final proposals,
- (g) decision.

In principle, the public should be invited to participate in the EIA process at as early a stage as possible, if only because they should be given adequate time to examine the case.

In the discussion it was suggested that public participation was most effective at the local plan or project level. However, although EIA studies are more difficult to manage at the regional and national levels, it is vitally important that they should include public participation.

Concern was voiced about the ability of the public to comment on scientific or technical issues, but it was agreed that the public could appreciate "issues" if these were presented in a form that could be understood by the layman. The effectiveness of public participation could be judged by the degree to which decision-making was influenced. The actual making of the decision was a step beyond public consultation.

2.6 Participation of health professionals in the EHIA process

The role of the health professions in EHIA may be defined simply as the provision of information which will enable a prior assessment to be made of the possible hazards to health associated with man-made changes in the environment.

The execution of this role, however, may be anything but simple. Problems arise because the data on which the decision has to be based are often lacking and, when available, may be inconclusive. In addition, there is often a time-lag between a change in the environment and the appearance of adverse effects and harm to health may also be the result of some unanticipated event, such as the biological transformation of a relatively safe chemical into one which is more toxic. Much more research in this area is required, preferably coordinated on an international scale and with agreed objectives and priorities.

Those providing the health input should do so during the planning stage of major projects. Since it will not be possible to assess all projects, some system of assigning priorities must be devised.

In order to ensure a sufficient number of specialists able to provide the health input, modifications in both undergraduate and postgraduate medical education are called for.

It is suggested that, in order to carry out the additional research and training called for in this paper, and to ensure that the results of past and future studies are readily available to those in the field, a number of centres should be established under the auspices of an international agency such as WHO.

In the discussion it was agreed that medical educational orientation is wrong: paramount importance is attached to hospital medicine while community medicine is largely ignored. Environmental medicine should be taught and the idea of community preventive medicine as a vocation should be promoted. The "sanitary physician" produced by medical schools in the USSR may be a model in this connexion.

Public health departments must be more broadly based, with the objective of shifting the emphasis from infectious diseases to environmental health, but they should be able to deal with both areas.

It was accepted that there is no clear idea of what constitutes an "acceptable risk"; similarly, there is no way of declaring an acceptable risk on behalf of society. The health professional must establish facts and contribute these to the comprehensive range of information upon which judgments are made by society.

There was general support for a check-list of factors contributing to environmental health to be included in codes of practice. The WHO information centres would be appropriate bases for such work.

2.7 Model code of practice for the EHIA process

Although the task of developing an up-to-date, accurate and useful code of practice may appear awesome, particularly to developing countries, it clearly is a feasible, and virtually unavoidable, first step towards a viable EIA process.

The first stage in developing a code of practice involves the development of a data base, the data for which are drawn from key national and international sources. Then, utilizing a cross-sectoral and interdisciplinary approach, the full range of potential environmental health effects may be identified, including the impact of degradation of the ambient environment resulting from air, water and land pollution, as well as from noise, crowding and stress. Factors relating to the occupational environment and the personal environment, involving food, chemicals and other products in everyday use will also be considered. In this way the potential total body burden and the cumulative stress on ecosystems may be estimated.

Drawing on the effects study, environmental health criteria for permissible exposure to pollutants and other factors can be developed. Ambient, emission or effluent standards, occupational exposure standards, tolerance levels for food, drugs and other products, as well as handling, use and disposal standards for hazardous materials may be derived from these criteria.

With this code of practice available, individual actions which have a potential environmental health impact may be readily assessed. These will range from major national or even international policies, for example, in energy development, to regional development programmes and to such projects as effluent outfall systems, irrigation and hydroelectric schemes and new tourist facilities.

The EHIA, like the EIA as a whole, should be the responsibility of the initiator of the action, be it a government office or a private developer. Use should be made of the guidelines, advice and general supervision provided by the government bodies responsible for actions of the type proposed. The focal point of the EHIA should be the national environmental office or its regional or local counterpart, depending on the size and location of the activity.

The approval and review process for the EHIA should be basically the same as that for the action itself, with the important proviso that all environmental ministries or departments and the public should be allowed to comment on each alternative being considered.

Finally, the actual, as opposed to the expected, results of the action should be carefully inspected and monitored: On the basis of the feedback of data from such monitoring, the environmental health code of practice and EHIA procedures should be updated and expanded appropriately for the future.

In the discussion it was agreed that the EHIA process was best incorporated in the planning process, whether the latter was at the national, regional or local level.

Socioeconomic considerations must be weighed simultaneously with environmental health considerations, but traditional cost/benefit studies are not enough. A specialist branch of economics is sought, leading to the development of "environmental economics".

All projects should be divided into two categories: reversible and irreversible, and projects which create environmental impacts that are irreversible should have priority.

It is important to work with the promoter of a project from the very early stages of the planning process. It is too late to do so when the plans have been finalized.

While it is recognized that international organizations reflect the collective will of the Members States, it is important that WHO should exert its influence to the maximum in the field of EHIA.

Multilateral and bilateral funding institutions should be encouraged to use EIA in the evaluation of projects.

2.8 International collaboration

The importance of a holistic approach to environmental health was stressed by the committee of international experts who reviewed the WHO Regional Office for Europe's long-term programme in environmental health at a meeting in Vienna in 1977.

The complexity and cost of research necessary to establish the factual bases for decisions call for international action to rationalize this effort and to share the benefits of the results.

The ever-increasing role of international trade in our economic activities requires the harmonization of approaches to environmental control on the part of importing and exporting countries alike, to ensure that the export of goods and products is not accompanied by the indirect and involuntary "import" of environmental pollution.

Environmental health control programmes require multidisciplinary teams of scientific, professional and technical personnel with a common goal and a common background in environmental protection. International collaboration in the training of such skilled personnel is required to assure their availability.

The purpose of the EHIA system is to identify *a priori* the possible and likely environmental health consequences of a proposed action, so that negative impacts can be avoided or minimized by applying the best suitable technology or, if this is not possible, by considering alternatives to the proposed action which would avoid detrimental effects.

This is a preventive approach *par excellence* and, in the long run, it is bound to be both more effective and less costly than existing efforts to eliminate the consequences of past actions, which often ignored the environmental impacts until they became unbearable.

Different countries have different approaches to environmental impact assessment, including the health component. In spite of these differences in approach, many important common elements have been noted, which can form a basis for effective international collaboration.

In particular, there appears to be a definite need for:

- (a) factual information necessary for the assessment of impacts and for subsequent decisions;
- (b) improvements in the methodology of both the assessment and the review thereof;
- (c) dissemination of information generated through the assessment process;
- (d) development of personnel capable of fulfilling the above functions adequately.

In view of the problems which almost all countries are now experiencing in the evaluation of hazards relating to the production, transportation, consumption and disposal of potentially toxic materials, it is important that WHO's activities in this field should be greatly strengthened. Without more data on health effects it will be impossible to develop a rational basis for EHIA. In particular, it is important that the recommendation contained in resolution WHA31.28 concerning the establishment of a central unit at WHO headquarters to coordinate the efforts of institutions participating in evaluation of the effects of chemicals on health should be implemented without delay.

WHO should take the initiative in developing a code of practice for environmental health impact assessment as a matter of urgency. This could be achieved by employing consultants and working groups of experts and/or by commissioning national institutions to execute the whole or parts of this task under contracts or other cooperative arrangements.

An international effort should be made to assist governments in the training of multidisciplinary scientific, professional and technical personnel. One objective of this training would be to improve the capacity of environmental personnel to deal with the EIA process in general and with the health component thereof in particular. A second objective would be to improve the capacity of physicians and other health personnel to participate actively in the EIA process and to play a leading role in the health component thereof. A regional reference centre should be designated which, in conjunction with WHO, would have the task of stimulating research, developing methodological tools and assisting in training efforts.

Considering the complex nature of the EHIA process, it may be preferable to designate more than one reference centre or, alternatively, to designate subcentres to deal with components of the process requiring a high degree of specialized expertise in such areas as environmental toxicology, environmental medicine, environmental control technology and environmental planning. The functions of the collaborating centre would be to coordinate and synthesize the work of such specialized sub-centres.

3. WORKING GROUP SESSIONS

3.1 Major hydraulic works, Aswan, Egypt

The construction of the Aswan Dam and the creation of Lake Nasser, which covers an area of approximately 7000 square kilometres in Egyptian and Sudanese territories, is a huge multipurpose economic and social development project completed in 1975. During the planning phase of the project no comprehensive assessment of the impact on health was carried out in spite of the warnings about expected ecological changes, particularly with regard to the possible spread of schistosomiasis.

During the construction phase certain measures were adopted to control the possible invasion of exotic disease vectors from neighbouring Sudan. *Anopheles gambiae*, the notorious vector of malaria, is of special importance in this respect. Onchocerciasis and kala-azar are also endemic in northern Sudan in localities 400 kilometres from the Egyptian border. The arid desert around the lake and the absence of transport routes are natural barriers against the propagation of disease vectors. However, the current plans for agricultural reclamation and the resettling of population around the shores of the lake necessitate a critical evaluation and strengthening of the control measures already implemented.

The spread of schistosomiasis consequent upon the change from basin to perennial irrigation, and the recent establishment of snail vectors of intestinal bilharziasis in Upper Egypt, are being discussed in relation to changes in ecological and environmental conditions.

Findings

The expected spread of vector-borne diseases in association with major hydraulic works like that at Aswan emphasizes the need to incorporate EIA in the planning stage of such projects.

The experience gained in the Aswan development also demonstrates the importance of including in the project budget an appropriate sum for preventive measures and for dealing with possible postdevelopment health consequences.

When considering the environmental health impacts of such projects as large hydraulic works, it is important not to overlook any possible trans-boundary effects.

3.2 Major industrial development, Fos-Berre, France

The creation of the industrial complex at Fos-Berre, France, resulted from the conjunction of many economic, geographical and political factors.

The area had become a focus of attention of the petroleum industry prior to 1950 but in 1957 it was selected for major industrial development in many other sectors, petrochemicals, energy, etc.

The rapid industrialization of the area in terms of pollution and its consequences, ecological damage and effects upon human health resulted in public and political reaction directed at controlling further development and dealing with the environmental damage which had occurred. Standards were established and imposed upon new industries, while existing industries were required progressively to reduce pollution and achieve the standards within a given time. Although the urban growth capacity of the area had previously been set at a much higher figure, this was later established at about 200 000.

Environmental monitoring procedures were set up and a computerized central recording centre established to receive information from 15 locations in the Fos area. At this centre a warning system has been introduced, the aim of which is to reduce the levels of emissions from factories during critical climatic conditions, e.g., temperature inversions.

The aim of the whole environmental management system as it now exists is to maintain a balance between industrial and urban development and the capacity of the local environment to tolerate such development without damage to the flora and fauna and particularly to human health. The introduction of these measures should, however, have preceded development, not followed it.

Findings

In the light of the experience gained in the development of this major industrial complex, there is clearly a fundamental need for EIA, with emphasis on the health component, to precede any development. The planning of such development should be based on:

- (a) a framework of national strategy planning decisions,
- (b) a regional structure plan,
- (c) local development projects.

Environmental health aspects should be taken into consideration at each level of planning. On this basis, the capacity of the selected location to accept the proposed development should be established by EIA; this will include consideration of the various aspects relating to human health.

3.3 Metropolitan Area of Athens, Greece

Water pollution is increasing throughout the world and the safe collection and disposal of liquid wastes from municipalities and industry remains one of the major problems confronting all the developed countries.

The Athens Metropolitan Area has been discharging its liquid wastes, practically untreated, into the Saronic Gulf for many years, resulting in a progressive deterioration of the water quality of the Gulf.

The Government of Greece has taken cognizance of these facts and, as of February 1977, initiated a Master Plan, Feasibility Analysis and Preliminary Engineering Design in order to find satisfactory solutions to this problem.

The various environmental health factors which have been and are being taken into consideration in the above Master Plan are:

- (a) existing sanitary conditions of the marine environment;
- (b) effects of liquid waste discharges on the environment as far as public health is concerned;
- (c) type, degree and location of required treatment and disposal facilities, in relation to sensitive recreational areas;
- (d) priorities for the replacement of septic tanks by sewerage, dictated mainly by public health considerations;
- (e) required health standards for effluent and recipient water quality.

The primary motive for the project was health-based and its most important recommendations regarding the sewerage system and sea outfall as well as the types of treatment and permitted industrial effluent were all influenced, if not determined, by considerations of human health.

Findings

The experience of the Athens Metropolitan Area in studying the disposal of liquid wastes demonstrates the use of public health criteria as a base for the development of engineering design criteria.

EIA is of great value in this field of work; particularly important is the ability, within the process, to consider alternative methods of dealing with liquid wastes in order, *inter alia*, to select the optimum solution.

Fundamental to the success of activities ensuing from the EIA is the availability of adequate machinery for enforcing the health standards and realizing the objectives upon which the design criteria are based.

3.4 Tourist development in coastal areas, Yugoslavia

Since 1967, as a result of cooperation between the Yugoslav Government and UNDP, a number of important projects have been elaborated to identify the impact of tourist development on the natural resources of the Yugoslav Adriatic region. The rapid growth of the tourist industry since 1970 has made it necessary to investigate and assess the environmental impact of the development operations and to guide such development towards areas where there would be minimal adverse consequences.

The project for the Protection of the Human Environment in the Yugoslav Adriatic Region was initiated in 1973 for the purpose of carrying out research programmes related to various environmental components: quality of air, fresh water, sea water and soil (including the impact of wastewaters and solid waste); nature protection (including vegetation and landscape); protection of historical monuments; and interrelations between physical planning, environmental management and tourism. Special emphasis has been given to human health, and particularly to diseases appearing as a consequence of changed environmental conditions.

The established programme was performed by about 50 institutions, organized in research sectors and guided by sector leaders, while the project management was in charge of overall coordination.

Besides research programmes which were carried out over a period of 2-4 years, a conceptual model of aquatic and terrestrial ecosystem interactions was elaborated for the whole region, while in the area of the Upper Adriatic, where important development operations are under way, a test EIA was carried out and a study conducted on the forecasting and solution of problems concerning development versus environmental protection. Other activities included the mapping of future land use and investigation of environmental impacts on human health.

As a consequence of these numerous activities, control programmes have been established, monitoring has been instituted and a research programme initiated on many aspects of environmental impacts. The large volume of information and knowledge gained now forms an essential input into all EIAs which are undertaken as part of physical planning procedures and environmental management arrangements.

Findings

The experience amassed in promoting the large-scale development of tourist facilities in coastal areas of Yugoslavia indicates that the EIA process has an important role to play in this field, namely to establish planning criteria and health standards which will ensure that the capacity of the area to receive visiting populations is not overstretched. The sanitary infrastructure and the control of marine and shoreline pollution are fundamental elements of such operations if they are to be assured of long-term success and unwelcome environmental consequences are to be avoided.

3.5 Coal-fired power plants, USA

Environmental health damage to man and to the total environment can be quite severe from coal-fired power plants that do not follow good pollution control practices. Carbon monoxide, oxides of sulfur, oxides of nitrogen, hydrocarbons, and particulate matter may be discharged to the

atmosphere in particularly large quantities. In the USA it has been estimated that 15%–20% of these contaminants in the country's air may come from power plants. Other damaging air pollutants from coal-fired power plants, discharged in much smaller quantities, include mercury, arsenic, cadmium, chromium, copper, gallium, lead, selenium, zinc, and fluorides. The major threat to water is thermal pollution which, when uncontrolled, can be damaging to the aquatic food chain up to and including fish. Chromium, sanitary wastes, leachates from coal piles and polychlorinated biphenyls from electrical equipment are other possible undesirable water pollutants.

The damage that can be caused to human health by air pollutants ranges from respiratory function problems in the cases of the nitrogen and sulfur oxides to poisoning of the kidney, thyroid and brain by mercury. Vegetation may be stunted or completely destroyed by air pollutants and small mammals may accumulate undesirable quantities of metals in their systems. Fish may be stunted or even driven from their normal habitats because of thermal pollution and may be killed by excessive amounts of chlorine and its organic compounds.

Laws and regulations on air and water pollution control promulgated at the federal and state levels have corrected most of the more serious air and water discharges from these plants and greatly reduced the danger to environmental health from these sources. Such corrective systems as precipitators, sulfur removal systems and cooling towers have been quite effective in this regard.

With the establishment of guidelines for EIAs relating to this industry, a methodology has now been developed to ensure that a study of possible environmental health damage will be made prior to finalizing plans for new construction. The guidelines also require an adequate description of the various possible mitigating measures and their effectiveness. This presents the relevant authorities with sufficient information to attach such conditions to permits as will ensure proper environmental health protection.

Findings

As a result of the experience gained in developing coal-fired power plants in the USA, the usefulness of EIA and of establishing permissible levels of emissions has been well demonstrated. Furthermore, it has been shown that the process is most effective when, on the basis of EIA, a range of possible locations for power plants is determined and emission standards are established for each location, also secondary effects being taken into consideration. This permits the developer to make his own economic evaluation of alternative combinations of locations, fuels and technology. The need to develop simplified procedures and avoid excessive documentation has also been demonstrated.

3.6 Nuclear energy, United Kingdom

The potential environmental health hazard posed by nuclear energy can best be evaluated by consideration of those populations who are occupationally exposed to radiation and also of the general public living in the vicinity of a nuclear establishment.

The Windscale establishment is located on the north-west coast of England on a plain five kilometres wide between the sea and the foothills of the Cumbrian mountains. The site was previously an ordnance factory, but in 1947 work was started on developing it as the location for the plutonium-producing "piles" or reactors, and for the plutonium extraction plant.

The first "pile" reached criticality in October 1950, the second in June 1951. In parallel with the construction of the reactors, a chemical plant was built to treat the fuel rods after irradiation. The reprocessing complex was commissioned in 1951 and received its first irradiated fuel in January 1952. Fuel reprocessing on the site has therefore been in progress for just over a quarter of a century.

In considering the health impact of the Windscale facilities two populations may be identified: those (approximately 5000) who are occupationally exposed by reason of their work on the site and the general population of some 135 000 people who live and work within a radius of about 50 kilometres from the nuclear fuel processing facility.

This facility has processed some 20 000 tons of spent uranium fuel, during which time discharges of low-activity fission products have taken place to the sea within the limits imposed by the authorizing ministries.

The health of the work force has been continuously monitored during the whole period of the plant's operation and studies have been made of the incidence of various diseases and congenital malformations in the general population living near the establishment. It is very evident from these studies that the operation of this reprocessing plant has had no obviously deleterious effects on either of the populations considered.

The concern of most people is related not so much to the normal operation of nuclear plant as to the consequences of accidents. The safety directive which controls the design of nuclear plant is based upon the concept of the "maximum credible accident". Similarly, the containers for transporting radioactive material are designed in accordance with the same criteria.

In the storage of fission waste products increasingly sophisticated methods are being introduced, including the Harvest process for turning highly active liquid wastes into glass.

Findings

Existing evidence from the operation of nuclear fuel reprocessing plants in the United Kingdom does not show any apparent direct adverse effects

on the surrounding populations and the environment. It is realized, however, that this evidence is incomplete and that there is a lack of information on many aspects of the problem.

There is clearly a need for the EIA process to take place before such plants are developed, and the continuous monitoring of the health of those concerned with the operation of the plant and of the local population is of great importance. EIA should also be used to evaluate any possible accidents in the plant.

3.7 Oil and oil-related development, United Kingdom

In 1969 there was little evidence that oil or gas would be discovered in the northern part of the North Sea off the east coast of Scotland. Four years later, known discoveries indicated that sufficient oil could be recovered to meet the United Kingdom's consumption of 100 million tonnes a year, as well as gas equivalent to twice the current levels of consumption.

The onshore requirements for the exploitation of North Sea oil and gas resulted in the concentration of many unfamiliar and controversial development projects in a few areas; this development has had a profound effect on the social, economic and physical environment.

As soon as the demands likely to be made on land arising from the offshore activities could be assessed with a certain degree of probability as to location, type and extent, coastal planning guidelines were issued at national level. Processes were initiated with regard to procedural and institutional questions so as to establish how environmental assessment could be integrated in the planning process and how best to take into account developments in the attitudes of the public concerning the protection of the environment and human health.

On the basis of these guidelines and other supplementary information, together with their own detailed environmental survey, regional and local planning authorities started work on contingency development plans for all oil development areas.

Experience from this work and from the first development projects showed that a wide-ranging search for any relevant or significant impacts, whether environmental, social or economic, was involved. As a result of these activities it was apparent that a multidisciplinary approach was necessary, covering economic, social, ecological as well as environmental health issues. Experience suggests that, as far as environmental health is concerned, emphasis might be given in the first place to risk and hazard assessment and to the psychological and physiological consequences of uncertainty and disturbance.

Findings

A review of the circumstances surrounding the exploration and exploitation of deposits of oil and gas in the North Sea off the coast of the United

Kingdom indicates the need for adequate forward planning, taking into consideration the likely impacts on environment and health and including planning for accidents.

There is a clear need for closer cooperation between the governmental agencies involved, and for bringing the health agencies into the planning process at an early stage.

Considering the simultaneous development of EIA techniques in many different countries, there is a need for closer international cooperation, such as the establishment of an international reference centre for the collection and dissemination of information and experience on all aspects of EIA.

The international nature of the oil industry suggests that a strategic level of consideration should be added to the national-regional-local model and that international environmental consequences are sometimes relevant, indicating the need for priority consideration to be given to health impacts.

3.8 Reuse of liquid wastes, Israel

The development of Israel's sources of fresh water has reached its functional maximum point, and the continuing development of agriculture and industry now depends on the recycling of wastewater. Today, approximately 95% of Israel's natural water supply is utilized and about 20% of the total sewage water is being recycled in 250 reclamation plants throughout the country. The development of additional reclamation programmes is scheduled for the years ahead.

Although Israel is committed to an active policy for the reuse of wastewater, it is important to note that there are significant public health problems which must be dealt with. Despite the virtual elimination of such infectious diseases as malaria, tuberculosis, poliomyelitis, pertussis and measles, the incidence of enteric infectious diseases remains significantly higher than in other developed countries in the temperate zone.

On the more optimistic side, recent studies suggest that treated sewage water may, at relatively low additional cost, undergo further treatment prior to irrigation through solar radiation effects on micro-organisms (bacteria and viruses) sensitized by methylene blue or other dyes. Further investigation and monitoring is under way on this subject.

Newer irrigation methods being used widely in Israel, such as those involving subsoil drip irrigation, alleviate some of the microbiological effects of wastewater use in agriculture. New public health regulations on this matter are in preparation which will change the rules concerning the restricted use of treated wastewater for industrial crops such as cotton, orchard crops and some ground crops.

In summary, Israel is committed to a policy of increasing use of wastewater in agriculture. Experience over the past 30 years shows that public health concerns should be recognized but not exaggerated out of proportion.

Positive investigations of epidemiological events and improved measures to reduce microbiological activity must be encouraged. The utilization of inexpensive technologies based on renewable energy sources, e.g., biological or solar mechanisms, is yielding promising results.

Careful monitoring and investigation is required. Israel, like many other countries, has no choice but to find a way to reuse wastewaters, but great care is required to monitor and manage the public health aspects of the problem.

Findings

Israel's experience in the reuse of liquid wastes for irrigation is typical for many countries where the reuse of water is vital. Such reuse must be undertaken under strictly controlled conditions and health considerations are of paramount importance. The EIA process, with its ability to evaluate alternative methods and to specify the necessary safeguards, plays an important role.

Given the introduction of such procedures, the results so far obtained indicate that the reuse of liquid waste can be safely undertaken without adverse health consequences, provided that the necessary standards and control procedures are established and maintained.

3.9 Agricultural waste disposal, Czechoslovakia

Agriculture represents a substantial part of the national economy in Czechoslovakia. The dynamic development of agriculture benefits from the social, economic and political structure of the country as well as from its natural and climatical conditions.

A high degree of specialization has been achieved, and production has been concentrated in large units. Estates owned by cooperatives or the Government have areas of 2000–4000 hectares; some of them are even 20 000 hectares in area.

In connexion with progressive specialization, large-scale farms with industrial methods of raising animals have been formed.

Due to the methods employed in the intensive rearing of animals, the waste materials from large-scale farms are mainly in the form of liquid manure. Waste of this type, which comprises approximately 20% of the total manure production, amounts to some 7 million tons per year; 46% of it from cattle, 48% from pigs, and 6% from poultry.

Straw manure, which forms by far the greater part of animal wastes, is still used to dung fields. This is a classic example of recirculation without any serious adverse effect on environment.

The use of liquid manure for soil fertilization carries with it some health risks. Thus, measures have to be taken to protect human and animal health:

where liquid manure is applied to land, care must be exercised to ensure that the absorption capacity of the land is not exceeded.

In addition to liquid manure, there is another waste material – silage juices. The 20 million tons of silage produced yearly in the country yield approximately 4 million tons of silage juice. Here, too, steps have been taken to prevent this juice from endangering water sources.

Chemical fertilizers, in particular, can affect the environment in many ways, mainly by leaching into groundwater.

Pesticides are transported by water but also by wind and plants. They accumulate in the tissues of plants and consequently in the tissues of animals and man. Due to their structure they are toxic.

Findings

The development of intensive farming practices in Czechoslovakia offers valuable experience in the disposal of animal wastes.

High concentrations of animal wastes from intensive farm units generate environmental problems which can have adverse effects on human health.

The EIA process can be used here to establish an appropriate relationship between the scale of animal stocking and the capacity of the land to receive wastes, as well as in evaluating methods of treatment and disposal of waste without detriment to food crops, water-courses and human health.

The establishment of standards relating to the capacity of the soil to receive wastes from intensive farm units is an important element in the planning process and the socioeconomic aspects of the whole agricultural operation. The human health component is of high priority, nevertheless, and must be prominent in the EIA.

3.10 Development of the EIA process, Greece

The Secretariat for Physical Planning and the Environment was set up in 1976. One of the first projects it undertook was to study methods for introducing EIA procedures in Greece. At that time the only such provision set down by law was in the 1976 Mining Code.

Since then, the Secretariat has succeeded in incorporating such provisions in a variety of new laws pertaining to activities which may have an impact on the environment. Thus, the Law on the Protection of the Marine Environment states that all new activities that are located on the coast (e.g., industry, tourism, public works) and that may have an adverse impact on the environment, may be required by the appropriate licensing authority to draft an environmental impact statement (EIS).

The new law governing all quarrying activities requires that an EIS must be submitted among the documents filed for the granting of a quarrying licence.

Similar requirements were incorporated in a new draft Law on the Protection of the Environment from Industrial Activities. Environmental impact studies are already required for granting installation permits for industrial activities.

A committee set up by the Secretariat to study the method for introducing EIA procedures in Greece concluded that the experience of countries with a legal framework that imposes such procedures on all types of activities should be avoided.

Instead, the method to be followed should be to introduce assessment procedures in the existing framework of decision-making. This requires a detailed listing of all the projects with their eventual environmental impact and the procedures followed for their realization and operation, as well as suggested changes in these procedures so as to incorporate environmental control at all stages of decision-making.

Findings

Valuable experience has been gained in Greece in the establishment of EIA. Demonstrating as they do the ability to take account of the human health aspects, the efforts of the Greek Government are viewed with interest.

There are indications that the EIA process is more effective if adequate flexibility is built into the process, for example, to allow for less strict application of environmental regulations to existing industries, which may require additional time to perform satisfactorily, than to new industrial developments.

4. CONCLUSIONS AND RECOMMENDATIONS

Environment is one of the prime determinants of human health. Thus, the objective of achieving acceptable standards of health cannot be separated from that of attaining high environmental quality standards. Taking into consideration the existing situation with regard to environmental health impact assessment as reviewed during the Seminar, as well as the shortcomings and needs for improvement that were identified, the participants arrived at the following conclusions and recommendations.

1. There is a need for environmental impact assessment in the planning of projects and the formulation of strategies and policies for development; it should take account of physical, technical, economic, social and environmental health factors.
2. Environmental impact assessment should include an evaluation of alternative courses of action, including no action at all, as well as the determination

of necessary precautionary and control measures. Attention should be paid to the possibility of improving existing conditions. Both the construction and post-construction stages should be considered.

3. Human health requires more emphasis in future environmental health assessment; health professionals must be included in multidisciplinary teams if the EIA is to be an integrated and coordinated process.

4. A prerequisite in the execution of projects is the establishment of an adequate data base, including health indices, against which changes can be measured.

5. Assessment should be based on the total exposure of an individual to hazards from various sources, account being taken of all possible cumulative and synergistic effects.

6. Impacts and risks should be identified as precisely as possible and, preferably, be quantified. They must be ranked in order of importance, for weighing against other factors.

7. Community involvement should be facilitated, using all appropriate means including the development of monitoring and feedback systems.

8. Consideration should be given to land use and planning at all levels, as well as to any environmental implications for other countries.

9. To facilitate the necessary multidisciplinary and interdepartmental contributions, a single agency should assume the coordinating role and have responsibility for the monitoring and feedback.

10. Overall responsibility for environmental impact assessment will depend on national regulations but, whatever the machinery, account should be taken of the views of the appropriate health agencies.

11. In view of the finite assimilative capacity of the environment, the likely impact of associated developments should also be assessed.

12. WHO's activities relating to the evaluation of toxic hazards and health criteria should be strengthened and accelerated with a view to producing and publishing, as soon as possible, the factual data needed for decision-making.

13. A model code of practice for environmental health impact assessment could usefully be produced under WHO auspices, to assist governments.

14. An international effort should be made to assist governments in providing personnel with the necessary training and multidisciplinary orientation. Programmes could be developed to enable physicians and other health professionals to play an active part in the process, with particular reference to health.

15. An international or regional reference centre on environmental impact assessment should be established with the function, in conjunction with WHO, of disseminating information, stimulating research, developing methodology and supporting educational efforts.

16. Multilateral or bilateral financing bodies should require the inclusion of an environmental impact assessment component in the projects they sponsor.

Annex I

LIST OF DISCUSSION PAPERS AND CASE STUDIES

Discussion papers

1. Background and objectives of environmental impact assessment – Mr M. Giacobino
2. Overview of environmental impact assessment in various countries – Dr P. Lagos
3. Health effects of environmental impacts – Dr V.B. Vouk and Dr. J. Parizek
4. The role of health agencies – Dr R.H.E. Aurola
5. Participation of the public in the EHIA process – Professor A. MacLeary
6. Participation of the health professions in the EHIA – Dr H.A. Waldron
7. The role of health agencies – Dr R.H.E. Aurola
8. Model code of practice for the EHIA process – Dr U. Marinov
9. International collaboration – Dr M. Violaki-Paraskeva

Case studies

10. Major hydraulic works, Aswan, Egypt – Dr A. Abdallah
11. Major industrial development, Fos–Berre, France – Dr L. Grange
12. Metropolitan Area of Athens, Greece – Professor G. Markantonatos
13. Tourist development in coastal areas, Yugoslavia – Mr F. Gasparovic
14. Coal-fired power plants, USA – Dr J.I. Bregman
15. Nuclear energy, United Kingdom – Dr G.B. Schofield
16. Oil and oil-related development, United Kingdom – Mr D. Lyddon
17. Reuse of liquid wastes, Israel – Dr T. Tolchinsky
18. Agricultural waste disposal, Czechoslovakia – Dr J. Hojovec
19. Development of the EIA process, Greece – Mr M. Yeroulanos

Annex II

LIST OF PARTICIPANTS

Czechoslovakia

- Dr I. Fratric, Research and Development Centre for Environmental Pollution Control, Bratislava
- Mrs O. Hausknechtova, Research and Development Centre for Environmental Pollution Control, Bratislava

Egypt

- Dr A.G. El Azmerli, Deputy Director, Preventive Medicine, Directorate of Health, Giza

Greece

- Dr A. Daponte, Associate Professor of Biology, University of Thessaloniki
- Mrs K. Delidou, University of Thessaloniki
- Dr A. Economopoulos, Civil Engineer, Athens Environmental Pollution Control Project
- Professor T. Edipides, Medical School, University of Thessaloniki
- Mr G. Evmorfopoulos, Civil Engineer, Ministry of the Interior, Prefecture of Magnissia, Volos
- Mr T. Galatis, Civil Engineer, Ministry of the Interior, Prefecture of Kavala
- Mr E. Girovasiliou, Civil Engineer, Ministry of the Interior, Prefecture of Kavala
- Mrs E. Glenty-Kostikou, Health Laboratories, University of Thessaloniki
- Mr K. Kiriakopoulos, DEH (Public Electricity Co.), Athens
- Dr S. Kirikidis, Associate Professor of Food Hygiene, Veterinary Faculty, University of Thessaloniki
- Mr G. Koftis, Civil Engineer, Ministry of the Interior, Prefecture of Ahaïas, Patra

- Mr G. Kollias, Civil Engineer, Ministry of the Interior, Athens
- Mr P. Konstantinidis, Civil Engineer, Ministry of the Interior, Prefecture of Kozani
- Dr T. Kougioumdgis, Associate Professor of Analytical Chemistry, University of Thessaloniki
- Mr T. Krikakis, Administrative Officer, Athens Environmental Pollution Control Project
- Dr A. Mantis, Associate Professor of Food Hygiene, Veterinary Faculty, University of Thessaloniki
- Mr A. Panagiotou, Sanitary Engineer, Athens Environmental Pollution Control Project
- Professor J.A. Papadakis, School of Public Health, Athens
- Mr N. Spiropoulos, Chemist, Athens Environmental Pollution Control Project
- Mr P. Tsatras, Ministry for Northern Greece, Council for the Environment, Thessaloniki
- Mrs E. Valiantza, Sanitary Engineer, Athens Environmental Pollution Control Project
- Dr D. Vlahos, Medical School, University of Thessaloniki
- Mrs A. Voivonda, Architect, Technical Chamber of Greece, Athens
- Mr J. Vournas, Environmentalist, Athens Environmental Pollution Control Project
- Dr M. Zaphiropoulos, Epidemiologist, Athens Environmental Pollution Control Project

Iran

- Mr H.S. Manish, Senior Specialist, General Department of Environmental Health, Ministry of Health and Welfare, Teheran

Iraq

- Dr I.M.A. Al-Samawi, Directorate-General for the Human Environment, Ministry of Health, Baghdad

Kuwait

- Mr I.M. Hadi, Assistant Chief, Occupational Health and Industrial Pollution Control Section, Ministry of Public Health, Kuwait

Netherlands

Mr R. Seijffers, Ministry of Public Health and Environmental Protection,
Leidschendam

Poland

Mr W. Jedlinski, Vice-Director, Sanitary Inspection, Ministry of Health
and Social Welfare, Warsaw

Dr R. Kucharski, Environmental Pollution Abatement Centre, Katowice

Mr W. Kudela, Environmental Pollution Abatement Centre, Katowice

Professor S. Maziarka, Chief, Division of Environmental Hygiene, Na-
tional Institute of Hygiene, Warsaw

Portugal

Dr J.M. Santos Mota, Director, Environmental Protection Commission,
Lisbon

Turkey

Mr A.O. Urekli, Sanitary Engineer, General Directorate of Public Health,
Ankara

Yugoslavia

Dr S. Djordjevic, Public Health Institute, Belgrade

Dr A. Stragar, Health Centre, Celje

Representatives of Other Organizations

United Nations Development Programme (UNDP)

Mr H. Kamberg, Resident Representative, Athens, Greece

Consultant

Professor R.E. Nicoll, Department of Urban and Regional Planning,
University of Strathclyde, Glasgow, United Kingdom (*Rapporteur*)

Temporary Advisers

- Dr A. Abdallah, Technical Adviser to the Ministry of Health, Heliopolis, Cairo, Egypt
- Dr R.H.E. Aurola, Chief of Office, National Board of Health, Helsinki, Finland
- Dr J.I. Bregman, President, WAPORA Inc., Washington, DC, USA
- Professor F.M. El-Sharkawi,^a Institute of Public Health, University of Alexandria, Egypt (*Vice-Chairman*)
- Mr F. Gašparović, Republic Secretariat for Urbanism, Zagreb, Yugoslavia
- Mr M. Giacobino, Head of Central Working Group for the Environment, Ministry of Culture and the Environment, Neuilly-sur-Seine, France (*Vice-Chairman*)
- Dr L. Grange, Medical Inspector (Public Health), Ministry of Culture and the Environment, Neuilly-sur-Seine, France
- Dr J. Hojovec, College of Veterinary Medicine, University of Brno, Czechoslovakia
- Dr R.J.H. Kruisinga, WHO Adviser on Environmental Health Policies, Wassenaar, Netherlands
- Dr P. Lagos, Scientific officer, Secretariat for Physical Planning and the Environment, Ministry of Coordination, Athens, Greece
- Mr W.D.C. Lyddon, Chief Planning Officer, Scottish Development Department, Edinburgh, United Kingdom
- Professor A. MacLeary, Department of Land Economy, University of Aberdeen, Old Aberdeen, United Kingdom
- Dr U. Marinov, Director, Environmental Protection Service, Ministry of the Interior, Jerusalem, Israel
- Professor G. Markantonatos, Chair of Sanitary Engineering and Environmental Sanitation, Athens School of Hygiene, Greece
- Dr A. Paraskevopoulos, Scientific Adviser to the Ministry of Industry, Ministry of Industry, Athens, Greece
- Dr G.B. Schofield, Chief Medical Officer, British Nuclear Fuels, Ltd., Windscale and Calder Works, Seascale, Cumbria, United Kingdom

^a Participation expenses not paid by WHO.

Dr T. Tolchinsky, Director, Public Health Services, Ministry of Health,
Jerusalem, Israel

Dr Meropi Violaki-Paraskeva, Honorary Director-General, Ministry of
Social Services, Athens, Greece (*Chairman*)

Dr T. Waldron, Senior Lecturer, TUC Centenary Institute of Occupa-
tional Medicine, London School of Hygiene and Tropical Medicine,
London, United Kingdom

Mr M. Yeroulanos, Director-General, Secretariat for Physical Planning
and the Environment, Ministry of Coordination, Athens, Greece

World Health Organization

Regional Office for Europe

Dr A. Gilad, Senior Technical Adviser, Project on Environmental Pollu-
tion Control, Metropolitan Area of Athens (*Secretary*)

Headquarters

Dr J. Parizek, Scientist, Environmental Health Criteria and Standards

