

Pan American Health Organization

PAHO/ACMR/22/7
Original: English

TWENTY-SECOND MEETING OF THE PAHO
ADVISORY COMMITTEE ON MEDICAL RESEARCH

Mexico City
7-9 July 1983

ENVIRONMENTAL HEALTH AND RESEARCH

Programme for the Development of Research
on the Effects of Industrialisation on Health

The issue of this document does not constitute formal publication. It should not be reviewed, abstracted or quoted without the agreement of the Pan American Health Organization. Authors alone are responsible for views expressed in signed papers.

ENVIRONMENTAL HEALTH AND RESEARCH
PROGRAMME FOR THE DEVELOPMENT OF RESEARCH
ON THE EFFECTS OF INDUSTRIALISATION ON HEALTH
(ECO)

1. INTRODUCTION

The Pan American Center for Human Ecology and Health (ECO) is a Latin American and Caribbean Centre created in 1975 and is based in Metepec in the State of Mexico, approximately 70 kilometres from Mexico City. It is one of the technical branches of the Environmental Health Programme of PAHO.

The Center co-operates with the governments of the Americas in the avoidance of adverse effects on health which may result from environmental modifications that accompany industrialisation, urbanisation and economic development.

For a center such as ECO with its limited financial and professional resources - a staff complement of eight - it is not possible to tackle the vast array of ecological and health problems, potential or existing, associated with socio-economic development in its entirety. The Fourth ECO/Scientific Advisory Committee (ECO/SAC) which met in February 1982, therefore recommended that the Center concentrate on the interrelationships between industrialisation, population, environment and health, focussing on the effects of industrialisation on community and occupational health.

Based on the recommendations of the Fourth ECO/SAC and a subsequent internal PAHO assessment carried out in April 1983, ECO's work programme has been rationalised in the context of the other Programmes of PAHO. (see Annex I).

2. PAHO POLICIES AND PRIORITIES

The development of research and of appropriate technologies for health has been recognized as a principal component of the national and regional strategies for Primary Health Care which were endorsed by Resolution XX of the XXVII PAHO Directing Council in 1980.

The document which resulted from that Directing Council meeting - Health for All by the Year 2000: Strategies¹ emphasizes the need to:

- give priority to evaluative research and the identification and promotion of innovative technologies;
- define sector policies and programs, consistent with national science and technology policies, and obtain the participation of the sector in the definition of such national policies;
- develop coordinating mechanisms and programs of cooperation at the national and intercountry level;
- identify and exchange information between national institutions and between countries.

The same document also identifies priority programmatic areas related to environmental health in the Region.

A Plan of Action was subsequently adopted by the XXVIII Meeting of PAHO's Directive Council in October 1981² to provide a framework for im-

1/ PAHO/WHO. Health for All by the Year 2000: Strategies. PAHO Official Document N° 173. Washington, D.C. 1980.

2/ PAHO/WHO. Plan de Acción para la Instrumentación de las Estrategias Regionales. Official Document N° 179, Washington, D.C., 1982

plementing the HFA/2000 strategy. Among the priority fields for action are:

- the control of chemical and physical contamination;
- the prevention of detrimental effects caused by the development of hydrological basins or industry, on ecological relations or on human health;
- rural development in conjunction with health programs for agricultural workers and their families; and
- the safe application of pesticides and fertilizers.

ECO's programmes have been designed to address these priority areas. Until the present however the Center has not had a research budget and has not focussed on any research activities by itself, but rather has acted in an advisory manner within the context of PAHO's overall programmes.

3. PROBLEMS AND APPROACH

A WHO working group on Human Ecology and Health held at ECO 11-12 February 1982 identified the following social, organisational and technical constraints which impede effective handling of the problems.

"Psychosocial constraints"

Ecological implications are in many cases subtle and delayed in their action. Hence, there is an absence of awareness by the public and by governments of these implications. This in turn leads to the lack of public opinion on these matters.

Habits, behaviour and attitudes of the people are factors which may impede or facilitate coping with ecological problems. Inappropriate health-related practices and attitudes, reluctance to accept appropriate technologies and rushing to incorporate new technologies before they are evaluated are among examples of such psychosocial constraints.

Organizational and planning constraints

If knowledge and concepts of human ecology are to be applied in the context of socio-economic development where many problems must be addressed with insufficient resources, several organizational constraints will have to be overcome. These include the lack of future orientation in planning; the nonexistence or weakness of mechanisms for priority assessment at country level, of coordination among sectors concerned and of appropriate legislation and regulations; and the absence of recognition of the need for a key role for health agencies in overall socio-economic planning.

Technical constraints

The social and organizational constraints and the scarcity of resources in many developing countries are further compounded by technical constraints which include the following:

- information is poorly organized and presented; it does not reach persons who are directly concerned;
- there is a scarcity of people with appropriate training and ecological orientation;
- equipment is inadequate and often in short supply; and

- standards, for example, in environmental health protection, are often lacking, not generally applied, or inappropriate".³

Consonant with the existing constraints highlighted above ECO is proposing research to be undertaken mainly aimed at the development of methodologies, norms and criteria with the widest possible regional application.

4. PRIORITY RESEARCH DEVELOPMENT AREAS

Given ECO's mandate, the major programmatic area requiring research in relation to industrial development and health is the Assessment of Health Effects of Environmental Intervention or Modifications (often referred to as Environmental Health Impact Assessment). To develop satisfactory methodologies for conducting such assessments, research is required in the following fields:

- Health Effects of Exposure to Multiple Contaminants;
- Social Effects of Urbanisation/Industrialisation and their Related Health Implications; and
- Alternative Strategies for the Control of Vector-Borne Diseases- with reference to conflicting use of pesticides in agro-industry and public health.

ECO's activities in the field of environmental health should be viewed in the context of PAHO's overall programme and not in isolation.

3/ WHO Human Ecology & Health, Report of a WHO Working Group. ECO, Metepec, Mexico, 11-12 February 1982, pages 2 and 3.

To this end, it is suggested that there should be but one scientific advisory committee for the entire environmental health programme, rather than separate committees for ECO, CEPIS and headquarters. Such an approach should facilitate the development of a clear-cut, well established and coherent approach to the necessary research and the application of its results.

5. PROPOSED RESEARCH PROGRAMME ON HEALTH ASSESSMENT OF ENVIRONMENTAL INTERVENTIONS OR MODIFICATIONS

Historical Background

The concept of Environmental Impact Assessment (EIA) came to the fore of world attention after the United States of America's National Environmental Policy Act (1969) (NEPA) was passed on the 1st. January 1970. One of the key sections of the ACT [s. 102 (2) (c)] states that "whenever a federal agency proposes to take a major action having a significant effect on the quality of the human environment, it must prepare a detailed statement of the environmental effects and make this statement available to the President, the Congress and the American Public" (emphasis added). Five requirements must be dealt with in a U.S. Environmental Impact Statement (EIS):

- (a) the environmental impact of the proposed action;
- (b) any adverse environmental effects which cannot be avoided should the proposal be implemented;
- (c) the alternatives to the proposed action;
- (d) the relationship between local short-term uses of man's environment and maintenance and enhancement of long-term productivity;

and (e) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

The law does not specify what is a major action or a significant effect, nor does it stipulate what a detailed statement is. It was subsequently left to the courts during some 250 litigations within the first five years of the Act's existence, and to the Council for Environmental Quality (created by NEPA) to give more precision to those words.

Since the Act's implementations controversy has raged within and without the U.S.A. There are many people, including concerned environmentalists who believe that the EIS regulations have become a tool for obstruction, a procedural roadblock or a giant paperwork machine and that they have become far too physically and ecologically oriented to the detriment of the socio-economic and health benefits. Others believed that the regulations have become a highly significant and effective environmental tool for decision-making.* No doubt there is some justification for both observations.

Consequently it should not appear to be unreasonable to suggest that a comprehensive environmental impact statement, in the U.S. context, may be beyond the capabilities, either technologically or economically or both, of many of the developing countries of the world. Indeed the U.S. experience has led some countries, developed and developing to resist the concept on the bases on that: it would be too expensive; the necessary human and

* See S. Meyers in footnote 6, page 51.

technological resources do not exist; and that development would be stalled. The latter is a particular concern of developing countries.

The Need for Environmental Health Assessment Methodologies

Despite the foregoing it has been almost universally accepted that some form of environmental assessment of major projects be conducted. Major funding institutions have recently adopted policies to ensure that the environmental dimension is accounted for.⁴ Accordingly many pre- and post-development environmental assessments have been carried out in developing countries during the past ten years. The vast majority of the studies have been related to large-scale water resources utilisation projects. Consequently, for such projects a significant amount of methodological experience has been obtained, both with respect to health effects and also general environmental effects. This is also a field in which ECO already has considerable experience.⁵

Far less experience in developing countries has been gained however, for the assessment of other types of major development activities, such as: resettlement and colonisation schemes, transportation projects, industrial complexes, urban development, etc. It is mainly for these types of projects that satisfactory methodologies are required.

^{4/} A declaration of Environmental Policies and Procedures Relating to Economic Development was signed on 1 February, 1980 by the heads of nine multilateral funding and development aid agencies, and by UNEP.

^{5/} ECO/PAHO/WHO, Las Represas y sus Efectos sobre la Salud, Ed. Schorr, T.S et al. In Press.

The juxtaposition of: different political, cultural, socioeconomic, geographic, climatic conditions, etc; different levels of educational attainment, infrastructural development, technological development etc; and different types of diseases, their patterns of breeding, transmission and treatment, calls for a different focus and methodological approach to that which has normally been copied or adapted from the industrialised, generally temperate climate, countries.

The raison d'être for development projects in developing countries is the improvement of living conditions. Of paramount importance for the improvement of living conditions for most, if not all developing countries is the improvement of health. So often it is this aspect which is neglected the most in traditional environmental impact analyses (with the exception of large scale water-related projects). Because of the afore-mentioned differences between developed and developing countries, the health aspects of a major new industrial development in the latter may be completely different compared with the former, particularly the secondary and tertiary effects. A paper this short cannot go into details but as an example it is possible that a new industrial complex planned for a sparsely inhabited area will expose workers and families drawn from other areas to "natural" health hazards/diseases for the first time. Such exposure would be quite apart from the direct and known hazards associated with the industries.

Methodological Research

The search for appropriate methodologies must be oriented both at qualitative and quantitative techniques. Both approaches have their pitfalls, since even when there appears to be sufficient quantitative information, causal relationships are often not well understood. The very lack of understanding of the causal relationships causes problems in defining the information needed. It is a basic problem in using the results of simulation models.

As an example of a failed attempt at quantifying an impact, the case of locating the third London (England) airport may be cited "It would be churlish to deny that the Roskill Commission was of scientific value in this negative sense. As the greatest and easily the most expensive cost-benefit assessment ever conducted in Britain, it was instrumental in revealing the immense complexity of the variables involved in both time and space ... it can be seen to have been a clairvoyant charlatan."⁶

Hence the development of health assessment methodologies for environmental interventions or modifications should have a very close relationship with cause-effect research concerned with topics such as vector ecology, health effects of exposure to multiple contaminants, alternative strategies for the control of diseases and social effects on health of urbanization and industrialization.

6/ E. Brooks "On Putting the Environment in its Place: a Critique of EIA in Environmental Impact Assessment" Eds. T.O'Riordan & Richard Hey Publ. Saxon House England 1976 - page 169. See also D.W. Pearce, Measuring the Economic Impact of Environmental Change, Idem Ibid pp. 154-159.

5.1 Health Effects of Exposure to Multiple Contaminants

Quite often various groups of the community are exposed, either simultaneously or successively to several physical, chemical, biological and psychosocial factors which constitute specific and non-specific health risks. The recognition of the reality of multiple exposures on the one hand, and the data obtained through experimental toxicology on the other hand, has provoked anxiety over the possible aggravation of health problems caused by such multiple exposures that can act synergistically. One difficulty in conducting research is that evaluating the effect of combined multiple exposures is more complex and problematical than the study of single exposures. Hence it will be necessary to undertake new research to determine the effects of prolonged exposure to multiple factors, especially to those of low concentrations.

Animal studies have been conducted on the effects of solvents, groups of pesticides, groups of metals and irritant gases. Additive, synergistic and antagonistic effects have been noted in different reports.

It is difficult to extrapolate the results of studies on animals to the human exposure situation, since the experimental conditions do not truly reflect the exposure - effect/response of persons in their environment.

The experimental and epidemiological studies of combined exposures are still few and still unsystematised with respect to the availability of the effects of mixtures of chemical substances.

Other intrinsic factors can change individual susceptibility and among them can be mentioned some genetically determined modifiers such as hemoglobinopathies, lack of glucoso-6-phosphate dehydrogenase, lack of serum alpha₁ - antitripsine and anomalies of the serocolinesterase, all of which can increase the susceptibility to certain occupational diseases. Also, nutritional status can influence the response to exposure to chemical substances. Of special importance is the possibility that health damage can be increased as a result of the combination of exposure to environmental contaminants and personally determined factors such as smoking, consumption of alcohol, diet and drug use. Cigarette smoking increases the alterations caused by exposure to dusts such as cotton dust, silica and asbestos.

Consumption of alcohol aggravates successive hepatic disorders caused by exposure to chemical substances, above all, solvents. Diet and its various components, acts in several specific ways on the metabolism of chemical substances including carcinogens. Specific combinations are innumerable, but the fact that undernourished persons can be exposed to chemical intoxications in developing countries implies the need not only for research but also improved nutrition of the population at risk.

The present widespread and frequently indiscriminate use of medicines can have diverse influences on toxicity. There are common drugs, such as phenobarbitones, that at times increase the toxicity of certain chemical substances such as solvents.

There exist, also, various studies on healthy volunteers who were exposed to mixtures of substances such as ethanol and solvents medicaments and solvents, different gaseous irritants and physical stress. Among the observed effects can be mentioned changes in neurological function and behaviour, vestibular function and pulmonary function. All the studies with volunteers were based on short exposures in which both additive and antagonistic effects were observed, making it difficult to determine the importance of the findings.

Epidemiological studies on specific combinations of exposures are few, since they are difficult to document. Studies have been undertaken on the effects of exposure to: organic solvents; metals and mineral dusts; welding fumes and dusts, and foundary fumes.

Experimental and epidemiological studies of combined exposures should try to resolve problems that could be of real health importance. In this respect, a certain number of criteria for selection of study areas, have been recommended. Among them is certainty that the combined exposures to be investigated are actually found frequently in practice, and also the existence of a valid hypothesis of potential aggravation of health problems resulting from such combinations.

From a practical point of view, existing knowledge with respect to combined work related effects on health does not justify either the formulation of new recommendations for the revision of exposure limits to toxic substances in combined exposures, nor specific policies for workers

selection based on individual health habits. At the same time it is necessary to improve biological vigilance of combined exposures, for which new methods are needed. It is also necessary to establish systems that allow surveillance of the work environment in which there are combined exposures and to determine the resultant health effects.

One promising area for research is the use of biological indicators of contamination. One important potential is their capacity for determining the synergistic, antagonistic or additive effect of multiple pollutants. In spite of this important potential, little research has been carried out on this subject. Instead, most investigations on bioindicators have concentrated on the sensitivity of organisms to single substances.

Likewise, in Latin America, where financial resources are at a minimum, there is a need to promote awareness of the great utility of biological indicators of contamination already available for use. Increased awareness should bring about a search for indicator organisms more appropriate for tropical ecosystems, thus better adapted to some Latin American countries.

5.2 Social and Behavioral Components of Industrialization, Urbanization and Socioeconomic Development and their Relation to Environmental Change and Health

The declaration made by the governments of the world at the International Conference on Primary Health Care, Alma-Ata, USSR, (1978), explicitly recognizes that the attainment of health must be "based on

practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part ... of the overall social and economic development of the community." Implicit in the declaration is the existence of an understanding, or a body of knowledge about the social, behavioral and health characteristics of the individuals, families and communities undergoing development so that appropriate health improvement methods and technology can be put to effective use by them. Frequently, this kind of information is available, but experience has shown that it is not used systematically in the design of programs for the improvement of health on the local level.

The foregoing quote from the Alma-Ata declaration suggests a status view of individuals, families and communities, when in reality, this is far from the case in areas of industrialization, urbanization and economic development, wherein populations are in a continuous state of flux characterized by movement, resettlement, growth and change in the socioeconomic and behavioral characteristics. These observations point up once more the pressing need to assemble and incorporate systematically, into the planning and implementation of health improvement programs, baseline information on the socioeconomic and behavioral characteristics of the population at the local level.

With reference to environmental change and the effects on health and welfare in areas of industrialization, urbanization and socioeconomic development, two broad areas derive which merit an intensification of research:

I Perceptions, attitudes and behavior relating to environmental quality and health protection; and

II Social, economic and behavioral characteristics which affect the health and welfare of populations which move and resettle.

An intensification of investigations into these areas will provide basic information of use in practically all of the Organization's programs for the Region, and as the other sections of this proposal demonstrate, investigations into these areas can be tailored specifically to the information needs of any given program.

To take as an example the Program in Environmental Health Protection, the first area of investigation would concentrate on elucidating the features of life-style, local priorities and goals to be attained in populations undergoing development and environmental change, and how these affect their perceptions, attitudes and behavior with respect to environmental quality and the protection of - and improvement in health. This information would be essential for the mobilization of community participation in environmental health protection and improvement. It would help to identify psychosocial disturbances and pathologies which result from perceived hazards of environmental contamination, and to

prescribe remedies to alleviate them. It would contribute to the identification of stress - producing factors in the physical, biological and social environments and the effects they produce on community health, such as cardiovascular pathologies, carcinogenesis, mutagenesis and the like. It would form the necessary background against which information and education campaigns would be designed and promoted so as to produce better understanding among the affected public as to how they can alter their daily activities or organize themselves and their surroundings toward avoiding, reducing, or eliminating environmental contamination, and so forth.

A detailed understanding of how the movement and resettlement of populations relates to their health and welfare is ever increasing in importance especially with the intensification of industrialization, the quickening pace of urbanization, and the proliferation of projects of socioeconomic development, all giving impulse to population movement, relocation, and the accompanying problems in health and welfare. A significant number of the member countries in the Region of the Americas have for some time been committed to the implementation of programs designed to induce migrations for the purpose of the colonization and exploitation of underinhabited zones. In the process, people enter many times into unfamiliar environments, new settlements are constructed requiring the simultaneous establishment and operation of basic sanitation and essential health care services for the community, ecological relationships are modified with a potential for the establishment of conditions detrimental to health. Of fundamental importance in the protection and

improvement of environmental and community health is information on the social, economic, behavioral and health characteristics of the populations of colonizers as they were in their place of origin and as they find themselves at the new destination. The purpose being that of facilitating a readaptation to the new conditions of life and productivity while maintaining public health at an optimum.

Rural-urban migrations and resettlement have also come to create intense problems urgently in need of solution; the phenomenon of urban fringe settlements established by invasion or spontaneous occupation of marginal lands on the part of people seeking economic opportunities in the city creating in the process a situation of anarchy with respect to basic health care and sanitation. Periodic labor migrations are also on the increase, characterized by rural-urban movements for varying period of time depending on the urban work cycle, with an eventual return on the part of the worker to the rural home-base. And migrations coinciding with seasonal cycles in agricultural production, wherein a mobile labor force follows the availability of work in sowing, tilling and harvesting crops as they ripen, even in the face of increasing mechanization of agricultural production, still create problems in environmental and community health.

Only by intensifying the areas of investigation into these phenomena which will produce the basic information on the social, behavioral and economic organization of these populations will it be possible to plan in a coherent, integrated and effective way for the improvement and extension of health as declared at Alma-Ata.

5.3 Alternative Strategies for Vector-Borne Disease Control

On a global and regional basis the control of vector-borne diseases, largely through the use of chemical insecticides for vector control, has freed millions of persons over vast areas from illness and death. However the last twenty or so years have shown a continuous development of insecticide resistance on the part of the vectors, and a reduced development of new pesticides due to the cost of petroleum, labor and increasingly rigid and demanding registration requirements. The simultaneous use of similar pesticides in agriculture and in certain public health control programs (e.g. cotton and malaria) has exacerbated the problems in certain areas, most notably in Central America. As a result of these and other factors, especially socioeconomic ones, the results obtained in certain disease control programs in the last decade have been less than satisfactory. In reviewing alternatives recent reports by WHO^(7,8) focused attention on: a) testing of more degradable selective and efficient insecticides, such as pyrethroids; b) advancing development and testing of new application equipment and formulations to achieve target dose efficiency; and c) the continued development of integrated, including biological, control of vectors, and environmental pest management.

7/ Smith, A. and Lossev, O. 1981. Pesticides and Equipment Requirements for National Vector Control Programmes in Developing Countries 1978-1984. (WHO Unpublished Document) VBC/81.4.

8/ Smith, A. (ed.), 1982. Chemical Methods for the Control of Vectors and Pests of Public Health Importance. (WHO Unpublished Document) VBC/82.841.

ECO does not propose to work directly in the first two areas as this relates specifically to the program of HPT, but feels it is imperative to extend work in the third area, to complement and enhance the Regional program. Specifically we feel that research is necessary in:

- a) developing integrated and biological methods of control consistent with the conditions prevailing in the Region, and to develop research and training in the universities and institutions in the Region in this area. The WHO Specific Program on Tropical Diseases has sponsored such work and specifically asked for further development in the Americas;
- b) the social, behavioral and economic components of the rapidly changing rural life-styles of the Region, including the movements of people, the changes in agricultural practices (including the agricultural use of pesticides and integrated pest management practices as they develop), the perceptions, attitudes and knowledge which rural populations have about the respective benefits and risks of the various methods of control available to them, and the behavioral practices associated with the use of control methods which might produce detrimental effects on health;
- c) in addition to that mentioned above, efforts should be made to develop dialogue between agricultural and public health scientists in the countries of the Region. One aspect would focus on the possibility to coordinate pesticide usage, another to recognize that the majority of entomologists and pesticide users - including the small number trained in integrated and biological

- control - are in schools of agriculture, not public health;
- d) the influence of economic development projects (hydroelectric and multipurpose dams, irrigation schemes, and others that will change how and where people live) on overall health including the prevention or increase in transmission of vector-borne diseases. The WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control (PEEM) has addressed this area, and ECO could serve as the Regional focal point for its activities.

Training although often considered separately from research, is needed to accomplish the latter. The various facets of pesticide usage, especially human and environmental safety, require the development of research laboratories to carry out the required ecotoxicological work. We also need social studies using existing sources of information and sponsoring field investigations where called for, in order to establish local-level programs for detecting risks and instructing in how to avoid them by the adoption of appropriate practices.

Annex 1

PAN AMERICAN CENTER FOR HUMAN ECOLOGY AND HEALTH

Integration of the Program on the Effects of Industrialization on Health in Regional Programming

| | WORKERS' HEALTH | ENVIRONMENTAL HEALTH | EPIDEMIOLOGY | TROPICAL DISEASES | PROVISION OF HEALTH SERVICES | ADULT HEALTH |
|--|---|---|--|---|---|---|
| A. Training | 1. Preparation of basic material on occupational health | Preparation of material on appropriate use of pesticides. Preparation of basic material on toxicology | 1. Instructional material on epidemiological evaluation of environmental hazards | | | |
| B. Guides, manuals and criteria | 1. Guide on basic sanitation at work places | 1. Guide on analysis of health hazards in sugar industry 2. Guide on analysis of health hazards in copper industry 3. Criteria for establishment of minimum toxicology laboratory | | | 1. Occupational hazards of hospital personnel | |
| C. Methodological | 1. Criteria for self-evaluation of hazards by workers | 1. Dam construction Evaluation of health hazards | 1. Evaluation of effects on health of exposure to many pollutants. | | | |
| D. Research | 1. Use of aquatic plants to treat wastewater 2. Bioindicators of pollution | | | 1. the malaria-cotton complex. Comprehensive control | | 1. Epidemiological tendencies of cancer associated with environmental hazards in selected countries of the Region |
| E. Information | 1. Responding to requests for selective information 2. Promoting build-up of information | 1. Responding to requests for selective information 2. Promoting build-up of information 3. Sources of information on chemical disasters | | | | |
| F. Publications | 1. Guide to identification of occupational diseases (NIOSH) | 1. Quick evaluation of pollution 2. Human ecology and health (quarterly bulletin) | | 1. Biological effects of pesticides (series) | | |
| G. Inventory and analysis of regional infrastructure | 1. Available training centers | 1. Available toxicology laboratories | | 1. Institutions active in field of biological control | | |