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**DEVELOPMENT OF  
ENVIRONMENTAL HEALTH  
CRITERIA  
FOR URBAN PLANNING**

**Report of a  
WHO Scientific Group**

WORLD HEALTH ORGANIZATION

GENEVA

1972

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WHO SCIENTIFIC GROUP ON THE DEVELOPMENT OF  
ENVIRONMENTAL HEALTH CRITERIA FOR URBAN PLANNING

Geneva, 1-9 June 1971

*Members :*

- Mr A. O. Craig, Senior Planning Officer, Lagos Executive Development Board, Lagos, Nigeria (*Rapporteur*)
- Mrs N. Kharchinko, Chief of Industrial Sanitation and Air Pollution, Department of Sanitary Engineering, Ministry of Health, Teheran, Iran
- Dr M. Laird, Professor and Head of Biology, Memorial University of Newfoundland, St. John's, Newfoundland, Canada
- Dr B. Metz, Director, Centre for Bioclimatic Studies and Professor of Physiology, Faculty of Medicine, University of Strasbourg, Strasbourg, France
- Professor E. W. Mood, Chief, Environmental Health Section, School of Medicine, Yale University, New Haven, Conn., USA (*Chairman*)
- Professor G. I. Murav'eva, Docent, Chair of Municipal Hygiene, Central Institute for Advanced Medical Education, Moscow, USSR (*Vice-Chairman*)
- Mr V. Z. Newcombe, Director, Centre for Planning and Housing in Developing Countries, University of Edinburgh, Scotland
- Dr A. S. Perockaja, Chief, Service of Communal Hygiene, Department of Sanitation and Epidemiology, Ministry of Health of the USSR, Moscow, USSR
- Dr T. Racoveanu, Head of Radiological Hygiene Laboratory, Institute of Hygiene, Bucharest, Romania
- Mr A. K. Roy, Chief Engineer, Local Self-Government Engineering Department, Uttar Pradesh, Lucknow, India
- Mr N. Scotney, Technical Adviser, Society for Health Education, London, England
- Dr C. Woodbury, Professor of Urban and Regional Planning, The University of Wisconsin, Madison, Wis., USA

*Representatives of other organizations :*

*United Nations :*

- Mr Dina-Lobe, Secretariat, Stockholm Conference on the Human Environment, United Nations, Geneva, Switzerland

*Non-governmental organizations :*

- Mr C. Wasserfallen, International Union of Architects, Lausanne, Switzerland
- Mr F. Cottier, Permanent Representative, International Union of Local Authorities, Geneva, Switzerland

*Secretariat :*

- Mr J. de Araoz, Sanitary Engineer, Sanitation Services and Housing, Division of Environmental Health, WHO, Geneva, Switzerland (*Secretary*)
- Mr B. Goodey, Centre for Urban and Regional Studies, University of Birmingham, Birmingham, England (*Temporary Adviser*)
- Professor Maynard Hufschmidt, Departments of City and Regional Planning and Environmental Sciences and Engineering, University of North Carolina, Chapel Hill, North Carolina, USA (*Temporary Adviser*)

# DEVELOPMENT OF ENVIRONMENTAL HEALTH CRITERIA FOR URBAN PLANNING

Report of a WHO Scientific Group

## 1. INTRODUCTION

The WHO Scientific Group on the Development of Environmental Health Criteria for Urban Planning met in Geneva from 1 to 9 June 1971. Dr B. H. Dieterich, Director, Division of Environmental Health, opened the meeting on behalf of the Director-General and welcomed the members and the representatives of the United Nations, the International Union of Architects, and the International Union of Local Authorities. In his opening remarks, Dr Dieterich commented on the urgency for developing solutions to environmental health problems associated with the rapid growth of urban areas. He noted that virtually every Member State of WHO has critical and as yet unresolved problems of the city and its environment. These are not just problems of the more developed nations, but also of the developing nations. In pursuit of rapid economic growth, insufficient attention has been and is being given to environmental pollution created or aggravated by these efforts.

Dr Dieterich stressed the need for *comprehensive planning* at the national, regional, and urban levels—planning in which health considerations receive emphasis at least equal to the economic, cultural, social, and political issues. He noted that there is a serious lack of guidelines for urban planning, including those concerned with environmental health, and he therefore invited the Group to consider the following :

- (1) a review of environmental health factors of primary importance in urban and regional planning ;
- (2) an analysis of the adequacy of existing and available environmental health criteria for use in urban planning ;
- (3) a definition of areas where environmental health criteria are lacking, but are needed urgently to provide a sound basis for urban and regional planning ;
- (4) the submission of a series of recommendations concerning the development of criteria, standards, and guidelines pertaining to the environment that may be used in operational health and physical planning programmes.

During its discussions the Group also reviewed reports of previous United Nations and WHO meetings on subjects related to urban planning.<sup>1</sup>

## 2. GENERAL CONSIDERATIONS

Environmental health is concerned with the control of all physical, chemical, and biological processes, influences, and factors that exercise or may exercise, by direct or indirect means, a significant effect on the physical and mental health and social wellbeing of man and his society.

In relation to urban planning, two major environmental health goals may be identified. One is correction—the elimination or modification of present hazards of the environment to the health and social wellbeing of urban residents. This means correcting errors made in the past due to no planning, poor planning, planning that utilized inadequate criteria, or planning that ignored criteria. The other goal is prevention—the efficient management of environmental resources of an urban area in such a manner as to promote or enhance health and wellbeing and avoid hazards.

The Scientific Group formulated 6 specific environmental health objectives, to be fulfilled by urban planning programmes in the attainment of these goals.

- (1) Prevention and control of transmission of infectious agents.
- (2) Prevention and control of human exposure to chemicals that are or may be hazardous to human health.
- (3) Prevention and control of human exposure to physical agents that are or may be hazardous to human health.
- (4) Prevention and control of those biological, chemical, or physical agents that cause or may cause anxiety.
- (5) Promotion or enhancement of physical wellbeing.
- (6) Promotion or enhancement of social wellbeing.

Environmental health criteria were defined as scientific, objective, and systematic descriptions of the immediate and ultimate effects of certain environmental factors on the health and well-being of man ; they are often

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<sup>1</sup> Particular attention was given to the following : (1) United Nations (1963) *Metropolitan planning and development*, New York (document ST/TAO/Ser.C/64) ; (2) WHO Expert Committee (1965) *Environmental health aspects of metropolitan planning and development : Report*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 297) ; (3) World Health Organization Meeting on Health Effects of Urbanization (1970) Geneva (unpublished report). Other WHO publications dealing with environmental health criteria for urban planning are listed in the Annex.

used as a basis for evaluation or for reaching a decision on a proposed course of action. They express the best scientific knowledge available at the time regarding the known cause-and-effect relationship between specific environmental factors and human health and wellbeing. They can also be used as tests that permit the determination of the nature and magnitude of the effects of certain environmental factors on man and his environment.

In establishing environmental health criteria for urban planning, consideration should be given to existing and changing urban environments, to the living patterns of city residents, and to the behaviour, level of knowledge, beliefs, and attitudes of people, with full awareness of the possibilities and the problems of implementation.

### **3. IMPORTANT ENVIRONMENTAL HEALTH FACTORS IN URBAN PLANNING**

#### **3.1 General**

At a WHO meeting in November 1970 in Geneva on Health Effects of Urbanization it was recognized that the city is not only an environment in which people live but is also a physical-social system with direct and indirect effects on health. As an environment the city may be viewed as being made up of two parts, the natural environment, e.g., site, geology, climate, and the created environment made up of buildings, streets, and other components of city morphology. These physical environments of urban areas are interwoven with demographic, social, economic, cultural, and political factors, forces, and conditions and while the fabric of this interweaving is different for each urban area, there are many common characteristics. Urban planning for both new and existing areas should recognize the ecological significance of the interaction of man not only with his physical environment, but also with his socioeconomic, cultural, and political environments.

Until recently, environmental health specialists were concerned with urban climatology only as an aspect of air pollution. However, the development of applied climatology has indicated that in addition to providing valuable information on the behaviour of pollutants in the atmosphere, it can provide valuable assistance to urban planners in producing designs that provide healthy and comfortable conditions. Recent studies have shown that climatic conditions prevailing in cities can differ appreciably from those of the surrounding countryside and may have important effects on the health of residents of the urban areas.

In October 1968 in a Symposium jointly sponsored by WHO and the World Meteorological Organization on Urban Climates and Building Climatology, it was pointed out that "most modern cities have developed in a haphazard manner, with little or no regard to the climatic environment

concerned. Climatic factors are usually taken into account only in the construction of individual buildings".<sup>1</sup> It was noted that, as yet, there were no meteorological tools readily available for and applicable to urban planning. It was also noted that certain environmental health issues in urban planning associated with climate could be clarified if some form of mathematical model for the prediction of pollution could be developed and made readily available to the planner.

### 3.2 Components of urban planning

A fundamental goal of urban planning is the creation of the most favourable conditions of life for all the urban population, at work, at home, and at leisure. This means fulfilling as far as possible the six objectives of environmental health listed in section 2. Urban planners often approach their task by dividing the planning area into elements such as residential areas, industrial sites, etc. Adopting a similar course, the Scientific Group discussed the needs for environmental health criteria in urban planning under the following headings: (1) land use zoning; (2) residential areas; (3) industrial sites; (4) transportation and communication; (5) utilities and services; (6) miscellaneous considerations.

#### 3.2.1 *Land use zoning*

In the development of a comprehensive urban plan, it is necessary to allocate land to fairly broad categories of use such as residential, industrial, and commercial, to indicate the size of such districts and the linkages between them, and to select sites for public uses and facilities such as schools, medical care centres, public parks, and playgrounds. In urban areas the availability of land is usually a limiting factor in the development of a proposed programme of action stemming from increased needs due to growth of population, household formation, migration from rural areas, and higher space standards. These problems, though identified and well known, are difficult to quantify in terms of land needs, and are therefore difficult to relate to definitive environmental health criteria and to suggested guidelines for action.

In existing urban areas, it is often difficult, if not impossible, to make major changes in land use areas and their linkages. There may be geographical or physical obstacles to contend with. There may be cultural, social, or political barriers to change. The Scientific Group believes that as far as is possible and practical urban planners should be guided by the following general criteria in developing a generalized scheme of land use for new as well as for existing cities.

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<sup>1</sup> *WHO Chronicle*, 1971, **25**, 161-167.

- (1) Before allocating land for defined uses, consideration should be given to the meteorological, hydrological, and biological characteristics of the urban area as a whole and to its segments.
- (2) Meteorological conditions should be such as to minimize potential problems of air pollution, particularly in the residential areas.
- (3) The time spent in travelling from residential areas to places of employment and of rest and recreation should be as brief as possible. Distance is not necessarily the only factor, the mode of transportation is also important.
- (4) All built-up areas—residential, industrial, commercial, and public—should be provided with a continuous supply of potable and palatable water under pressure, without undue expenditure of financial resources.
- (5) It is essential to provide for the efficient and effective collection, removal, and treatment, as necessary, of all liquid wastes, including storm water drainage, and of all solid wastes.
- (6) Built-up areas, particularly residential areas, should not be subject to flooding, even at infrequent intervals.
- (7) Residential areas should be relatively free from insects and rodents that may be vectors or reservoirs of human disease or that may interfere with the attainment of physical and social well-being.
- (8) The arrangement of land use should permit the development and maintenance of meaningful social relationships, free from undesirable isolation or segregation.

The above criteria are very general and can be used to develop general guidelines. Specific criteria are needed for the development of specific guidelines for land-use planning.

By preserving some of the natural features and characteristics of the land, urban planners can promote the health and well-being of man and his environment simultaneously. The additional responsibility of establishing conditions that will also facilitate education and scientific, cultural, economic, and technological advancement may conflict with other considerations. For example, conservationists may vigorously work for the preservation of marshes in the interest of unique wildlife, while engineers may consider the same areas to be major impediments to proper drainage, and vector control specialists may point out their actual or potential disease transmission hazard. Since such conflicts are best resolved at the earliest stage possible through sensible compromise, urban planners have a duty to work in full consultation with experts, interested bodies, and individuals from relevant fields from the very beginning of a project.

3.2.2 *Residential areas*

The Scientific Group acknowledged the generalized environmental health criteria developed by the Committee on the Hygiene of Housing, American Public Health Association<sup>1</sup> and endorsed them as being valid for general application. However, they felt that knowledge of environmental health factors of residential areas had developed to the point where other generalized criteria could be added to this fundamental list. Further, these criteria are not sufficiently comprehensive to be basic to all 6 objectives of environmental health in urban planning enumerated in Section 2.

Certain sociophysical factors of the environment of predominantly residential areas are essential to the promotion or enhancement of physical and social wellbeing of the residents. For example, people need to form relationships of two kinds (*a*) formal and recognized—in clubs, associations, civil, political, and cultural groups and (*b*) informal and sporadic—neighbourly, arising from day-to-day contact in shops, at work, when using transport. Such relationships are vital for personal development and social wellbeing, and for reducing stress and anxiety.

Certain consequences of the importance in the planning of sociophysical aspects of residential areas can be stated as planning criteria :

(1) People should be considered by urban planners not only as residents of large cities, but also as members of communities, neighbourhoods, and networks within those urban areas.

(2) Such communities should be planned or maintained as residential units with recognizable spatial limits, so that people can identify themselves with their locality.

(3) The residential clusters—neighbourhoods, districts, sub-communities—should have easy communal contact routes within and between them.

(4) A range of facilities—schools, stores, and buildings for recreational and assembly purposes—should be provided to encourage the development of interacting community units.

(5) Through traffic should, as far as possible, be kept from straining or severing community interactions and relationships.

In addition to the above-listed criteria, provision should be made for safe and easily identifiable access to units in a residential neighbourhood and for a balance between the opportunities for privacy and for community interaction of the individual and the family within the residential environment.

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<sup>1</sup> American Public Health Association Committee on the Hygiene of Housing (1948) *Planning the neighbourhood*, Chicago, Public Administration Service (*Standards for healthful housing series*).

The Scientific Group felt that greater emphasis should be placed on the provision of open spaces in the development of housing units in residential areas so as to make the best use of fresh air, air circulation, and sunshine. Open spaces may already have plant cover meriting preservation. If not, they can be appropriately landscaped and planted. Play lots, playgrounds, and parks are means of making maximum use of some open spaces for the benefit of the community. Open spaces can provide some of the resources needed for active and passive recreation and can also contribute to the attainment of a sense of well-being through the provision of aesthetically pleasing natural settings.

While non-residential land uses in residential areas are generally considered undesirable and may create hazards to health and well-being, some admixture would be acceptable, provided it conforms with modern "performance zoning" regulations,<sup>1</sup> which are in accord with the objectives of environmental health outlined in section 2. In fact, certain allowances for limited service and inoffensive industrial land use in residential areas can reduce the time a worker spends in travelling to and from his work.

In order to attend to the needs of a relatively heterogenous population, as determined by such factors as age, socioeconomic levels, and family size, the planning of residential areas should provide for a mixture of dwellings by type, size, economic value, etc., so as to minimize the stress and anxiety caused when a person or family has to move because of changing conditions. Residents should be able to move within their neighbourhood as housing desires and needs change. The type of dwelling units provided should not cause physical, cultural, or social isolation. For example, the construction of tall apartment blocks for the exclusive occupancy of elderly persons would be undesirable unless compensatory communal facilities were provided.

The Scientific Group, although aware that the planning of individual dwelling units was outside its terms of reference, expressed the view that the urban planning process should encompass considerations of housing design. The individual housing unit represents the smallest but perhaps the most basic element in the urban planning process, and special care should be taken to apply the full resources of scientific knowledge to the design of such units in relation to the environmental health objectives as outlined. Environmental health criteria, including those relating to the minimizing of vector breeding places, are clearly required at this level too.

### 3.2.3 *Industrial sites*

The layout of new urban areas and the re-design of existing cities are affected greatly by the location and organization of industrial sites. The

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<sup>1</sup> "Performance zoning" is the separation of land uses on the basis of measurable characteristics, such as generation of noise, fumes, and traffic, instead of by broad categories of residential, business, and industrial use (*Wld Hlth Org. techn. Rep. Ser.*, 1961, No. 225, p. 36).

following planning principles of special environmental health significance have been developed for the siting of industrial enterprises :

(1) Grouping together of compatible enterprises in industrial districts or " industrial parks " for the common use of roads and transport systems, sources of power, heat, and water, and treatment of industrial wastes.

(2) Placement of industries that are compatible with residential land use as close as practicable to the housing of workers so as to minimize the length of time spent in travelling to and from work.

(3) Use of buffer strips or " sanitary protection zones " between residential areas and those industries that may discharge or emit into the environment smoke, dust, odour, or noise.

(4) Provision of linkages and means of transportation between industrial areas and residential areas for the efficient movement of workers to and from work.

The following criteria were considered to have special application to industrial site planning :

(1) Industrial sites should be provided with facilities, devices, and means, to collect, remove, and treat all liquid and solid waste material generated by the industrial operations in a manner that will not adversely affect the health and well-being of the people or cause adverse or undesirable changes in the environment.

(2) The siting of industries that may discharge smoke, dust, odour, or other air pollutants into the environment should be based on meteorological and microclimatic considerations to prevent the creation of unhealthful or unaesthetic conditions.

(3) Industries that emit objectionable noise should be sited in locations where they will not cause undue disturbance.

(4) Industrial sites should be provided with an adequate water supply system, power system, and other services and utilities as required by the industrial establishments.

(5) Industries that have elements of risk to their operation, e.g., the manufacture of explosives, or utilization of hazardous, toxic, or radioactive materials, should be sited in such places and in such a manner as to minimize the hazards to residents of the urban area and to other industrial enterprises, and to reduce the possibility of causing undesirable environmental changes.

(6) Industrial sites should be provided with an adequate network of roads, transportation facilities, etc., to permit the efficient movement of workers to and from work without undue loss of time.

(7) Industrial sites should be provided with the facilities and services necessary to bring raw materials to the industrial establishments for processing or manufacturing into goods and to allow the finished products to be transported to the markets.

#### 3.2.4 *Circulation*

A basic goal in urban planning is the provision for transportation that will ensure safety as well as speedy and comfortable movement both within an area and between adjacent urban areas. Traffic problems and injury and death from transportation accidents can be reduced by making direct connexions from residential areas to places of work and to the city centre and by incorporating into the design of the transportation system separate routes for mass transportation facilities, vehicular traffic, and pedestrians. It is most important that separation of pedestrian from vehicular traffic should be provided along routes used by children and elderly persons.

The Scientific Group believes that the following represent basic environmental criteria for the planning of transportation within urban areas :

(1) Urban transportation should be planned to provide safe, easy, and efficient routes of travel and convenient means of communication. Consideration should be given to ways and means of reducing the time spent by persons or groups in their daily movements between their homes and their places of work, rest and recreation, the urban centre, and public establishments.

(2) The planning of urban transportation systems and facilities should be comprehensive in scope and include all applicable modes of transport, both public and private.

(3) The transportation system should be planned to serve the urban area and should not impair the basic community structure.

(4) Major highways or roads that carry a large volume of vehicular traffic should not be planned to pass through a residential neighbourhood and should not be located immediately adjacent to a residential area without the provision of a buffer strip or protective zone to reduce the hazards to residents of accident, noise, and air pollution.

Neighbourhoods and residential communities are entities characterized by networks of human interaction. Highways, streets, roads, bicycle paths, walkways, etc., should be considered as means of providing communications between individuals within and outside the urban area and planners should strive to improve and reinforce these communications.

Urban planners should also consider current trends of inter-urban transportation. Of special concern is the siting of airports. The environmental

health aspects of transportation by air are manifold. In addition to being a source of noise, jet-powered aircraft are capable of transporting infectious agents and vectors of human disease from one urban area to another in a very short time—minutes or a few hours at the most. They also contribute to the air pollution problem and, in the event of an accident, are likely to cause injury or death to a large number of people at one time. Environmental health criteria and guidelines are needed in the planning of urban airports.

### 3.2.5 *Utilities and services*

In most nations, the development of urban areas for modern modes of living requires that consideration be given to the provision of utilities. No urban area may be considered as healthful unless utilities are provided or space is left for their ultimate installation.

The scope of basic utilities will vary from nation to nation and from urban area to urban area of the same nation. The provision of a water supply, and waste water collection and storm water removal systems are, however, basic utility facilities for urban areas everywhere. Provision for the collection and disposal of solid waste is also a basic utility or service. In the more developed nations, the list of basic utilities for the built-up sectors of urban areas is enlarged by the inclusion of electricity and telephone services.

Several basic environmental health criteria for the planning of utilities in urban areas were suggested by the Scientific Group :

(1) All built-up sectors of urban areas should be provided with a piped water supply system that brings the water, under pressure, to the premises and is available continuously. The water should be potable and palatable, not deficient in any of the desirable constituents, and not unduly warm.

(2) Within the built-up sectors of urban areas, provision should be made to collect, transport, and treat all liquid wastes in a community waste water system of such design and capacity as to prevent the creation of hazards to human health, conditions offensive to aesthetic values, or conditions that adversely affect the environment. Under special conditions, sub-surface disposal of liquid wastes may be possible if sufficient open areas of permeable land are available immediately adjacent to the buildings.

(3) Adequate drainage for storm water should also be provided to prevent local flooding or the creation of unhealthful, hazardous, or undesirable conditions.

### 3.2.6 *Miscellaneous considerations*

The Scientific Group stressed the need for adequate provision in urban areas for community activities and services such as public health, medical

care, education, public administration, business, and recreation, as a desirable goal for the physical, mental, and social wellbeing of urban communities.

In general, the observance of existing criteria for urban planning would also satisfy environmental health requirements, and the drafting of any specific criteria need only be an extension of these existing criteria.

#### 4. SOME AVAILABLE ENVIRONMENTAL HEALTH CRITERIA FOR URBAN PLANNING

##### 4.1 Air resources conservation and air pollution control

In the development of criteria for the quality of air in urban areas, a number of factors need to be considered. Air pollution can cause or contribute to human disease or it can precipitate undesirable physiological responses. Pollutants that are malodorous can interfere with a sense of physical wellbeing. Pollution of air over cities can cause economic damage such as corrosion of metal or soiling and erosion of building surfaces. Some air pollutants are capable of causing significant and sometimes devastating effects on vegetation, while others are capable of impairing the health of animal life.

Air quality criteria for urban planning should give due consideration to all known cause-and-effect relationships and should therefore be established with the cooperation of many professional disciplines. Most existing air quality criteria are based upon the known effects of selected air pollutants on human health, and tend to be fragmentary and limited in scope.

##### 4.1.1 *International Criteria*

WHO has been interested in the development of criteria for air quality in urban areas for more than a decade. Between March 1963 and November 1965, five WHO scientific groups reviewed available knowledge of the biological aspects of environmental pollution in general and discussed air quality criteria in particular.<sup>1</sup> The groups advised on the types of further research needed to provide the information based on which missing criteria can be developed. They also warned of the danger of extrapolating data from industrial air quality guides to formulate community air quality guides and stressed the need for widespread and frequent measurement of pollutants, singly or in combination, for establishing criteria and guides.

A WHO Inter-regional Symposium on Criteria for Air Quality and Methods of Measurement (1963) noted that the standards relating to air

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1968, No. 406.

quality as adopted by the various countries are different because they are based on different criteria. It recommended that the development of internationally acceptable guides be based on rational criteria, which in turn are based on recognized public health principles.

Another WHO Inter-regional Symposium was convened in October 1970 for the purpose of reviewing activities and measures in various countries for the development of air quality criteria, guides, and standards.

#### 4.1.2 *National criteria*

A review of country standards for air quality has shown that in general they are based on two principles. In the USA and the United Kingdom the standards are based on considerations of economic, epidemiological, and engineering feasibility and reflect the acceptance of threshold values below which it is unlikely that there will be demonstrable impairment of health, irritation of the sensory organs, harmful effects on vegetation, visibility reduction, or other similar effects.

In the USSR, Czechoslovakia, and Poland, criteria are based on experimental toxicological evidence and on the concept that only those concentrations of pollutants in the air can be accepted as permissible that do not directly or indirectly exert harmful or unpleasant effects on man, reduce his working capacity, or have a negative effect on his physical or mental well-being.

In the USA the Air Quality Act of 1967 requires the Secretary of the Department of Health, Education, and Welfare to develop and publish air quality criteria. The Department (1967) adopted the following as attributes of clean air :

- (1) the health of even sensitive or susceptible segments of the population would not be adversely affected ;
- (2) concentrations of pollutants would not cause annoyance, such as the sensation of unpleasant tastes or odours ;
- (3) damage to animals, ornamental plants, forest, and agricultural crops would not occur ;
- (4) visibility would not be significantly reduced ;
- (5) metals would not be corroded and other materials would not be damaged ;
- (6) fabrics would not be soiled, deteriorated, or their colours affected ;
- (7) natural scenery would not be obscured.

To date the Department has developed criteria for : particulate matter, sulfur oxides, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen oxides.

In the USSR, there are three classes of standard used in establishing air quality, namely hygienic standards, sanitary standards, and technological standards.<sup>1</sup> Hygienic standards represent an ideal objective and conform to specific criteria. They are numerical indices of environmental conditions that are biologically most favourable to human existence. Since it may be impracticable temporarily to insist on the adherence to hygienic standards for economic, developmental, or other reasons, sanitary standards, are employed in the interim. These take into account technological feasibility and economic justification. They represent a compromise between science and practice and as such are necessarily provisional. Technological standards are primarily designed to prevent uneconomical waste of material. They are not related to environmental health criteria, but are based on economic and resource conservation considerations.

#### 4.2 Water resources development and utilization

The planning of water resources encompasses more than just environmental health aspects. In addition to planning for community water supplies, aquatic recreation, irrigation, and the use of bodies of water to receive waste water—all of which are of primary concern to public health officials—urban planners also consider the use of water for hydroelectric power, industrial processes, navigation, and wildlife propagation. Since fresh water is a limited resource, it may be necessary to consider each body of fresh water for several purposes, e.g., in planning a dam for hydroelectric power, community water supply, recreation and wildlife propagation should also be considered.

#### 4.3 Water pollution control

The protection of water resources from pollution and the treatment and disposal of sewage and industrial effluents involve very important public health considerations at both the planning and operational stages. Public health concern in water pollution covers organic and microbiological contamination of water by domestic sewage, chemical pollution from industrial and agricultural operations, etc.

There are many problems in planning for the sanitary disposal of liquid wastes from urban communities and the present criteria and guidelines are inadequate. In many of the developing countries water is scarce, particularly in arid and semiarid regions where rainfall is limited. Water that is unusable because of pollution represents a partial loss from the water resources of that nation. Urban planners in these countries should participate in water resources planning. Fortunately, most of the water pollu-

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<sup>1</sup> Rjazanov, V. A. (1965) *Bull. Wld Hlth Org.*, **32**, 389–398.

tion in the developing countries is caused by organic wastes and much is now known about the treatment of such wastes by inexpensive, yet efficient, methods.

The problem facing urban planners in the industrialized areas of the world, on the other hand, is often very complex. Liquid wastes may contain all sorts of pollutants. Detailed criteria and guidelines in this field are virtually nonexistent and should be developed as soon as possible.

#### 4.4 Land resources and pollution control

The Scientific Group noted that little attention has been given to problems of land resources and pollution control related to urban planning. For many years, regional and urban planners have been concerned with land use, and the development of land use schemes. However, as a rule their activities have not been directed toward the protection of land resources from pollution.

Land or soil pollution stems principally from 4 sources, (1) the indiscriminate disposal of solid wastes (refuse); (2) the unintended or incidental pollution of the soil with man-made chemicals; (3) the spent material from mining, ore processing, etc.; (4) the discharge of sewage or waste water from urban areas on to land used for agricultural purposes, particularly that adjoining urban areas. These 4 sources are capable of impairing vast areas of land and, through interaction and interdependence, may lead to both air and water pollution. Pollution of land with solid wastes is largely an urban problem, whereas chemical pollution may extend to rural areas where agricultural chemicals are used.

The disposal of solid wastes was among the subjects discussed in the first three reports of the WHO Expert Committee on Environmental Sanitation.<sup>1, 2, 3</sup> in 1956, a WHO Monograph discussed methods for the treatment of solid wastes by composting.<sup>4</sup> It reviewed health aspects and the fundamentals of the process and gave some guidelines for design. The publication of this monograph indicated the specific concern of WHO about the public health aspects of solid wastes management.

In 1960, the Regional Committee of the WHO Regional Office for the Americas, discussing the technical, administrative, legal, and financial aspects of garbage and refuse disposal, recommended that ministries of health should lend every possible assistance to the improvement of solid wastes disposal practices without becoming responsible for the operational aspects.

<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1950, No. 10.

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1952, No. 47.

<sup>3</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1954, No. 77.

<sup>4</sup> Gotaas, H. B. (1956) *Composting : Sanitary Disposal and Reclamation of Organic Wastes*, Geneva (*World Health Organization : Monograph Series*, No. 31).

Qualitative and quantitative surveys, and more research on solid wastes were among the suggestions made by the WHO Expert Committee on Environmental Change and Resulting Impacts on Health in 1964.<sup>1</sup> This Committee also noted an immediate need for the development of criteria useful to urban planners, environmental health specialists, and others, in solving some of the perplexing problems of solid wastes handling, collection, and disposal in urban areas and in coping with the continually changing characteristics of solid wastes being produced today.

The inclusion of solid wastes disposal as a basic element of metropolitan planning was endorsed by the WHO Expert Committee on the Environmental Health Aspects of Metropolitan Planning and Development in 1964.<sup>2</sup>

#### 4.5 Control of urban noise

In the past, concern about the effects of noise on health has been largely confined to occupational and industrial environments. Recently, owing to the rapidly increasing noise levels from many sources, such concern has spread to urban and particularly residential environments.

The WHO Expert Committee on Environmental Health Aspects of Metropolitan Planning and Development (1964)<sup>2</sup> noted that noise and vibration are known to exert deleterious effects on numerous organs of the human body, especially on the nervous system. It recommended that metropolitan planners and environmental health personnel should cooperate closely to ensure the creation of urban environments in which noise and vibration are reduced to a minimum. In order to achieve this goal, much work needs to be done to develop the criteria on which urban planning standards can be based.

Although explicit criteria for noise measurement and control in urban areas are still lacking, a good deal is known about these aspects and some countries have already taken legislative action with a view to instituting control measures. In 1960, the United Kingdom established a committee to "examine the nature, sources, and effects of the problem of noise and to advise what further measures can be taken to mitigate it". In 1963 the Committee submitted a comprehensive review of its findings.<sup>3</sup> Similar action in the USSR<sup>4</sup> resulted in a report that was used as a basis for establishing standards of permissible noise in apartment houses and in residential zones.

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1964, No. 292, p. 16.

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1965, No. 297.

<sup>3</sup> United Kingdom Committee on the Problem of Noise (1963) *Noise. Final Report*, London, H. M. Stationery Office (Cmnd 2056).

<sup>4</sup> Goromosov, M. S. (1968) *The physiological basis of health standards for dwellings*, Geneva, World Health Organization (*Publ. Hlth Pap.*, No. 33, p. 74).

The WHO Expert Committee on the Public Health Aspects of Housing (1961)<sup>1</sup> noted that appropriate protection from noise is one of the important requirements for a healthful residential environment and suggested that community planning should restrict noisy operations in residential areas.

#### 4.6 Control of radiation

One of the technological developments of the Second World War period and subsequent years has been the increasingly widespread use of both ionizing and nonionizing radiation. Unless rigidly controlled, these radiations constitute health hazards.

Standards for the control of ionizing radiation go back to 1928 when the International X-ray and Radium Protection Commission was established. They have become more stringent with increasing knowledge of the hazards associated with its use.

While there are, and will continue to be, many sources of ionizing radiation in urban areas, primary concern in environmental health should be centred on the siting of stationary nuclear energy power reactors and the possible use of mobile power reactors. The following two situations are fundamental to all planning considerations for the use of nuclear energy power reactors :

- (1) Economic and other factors may dictate the location of stationary reactors in or immediately adjacent to urban areas.
- (2) There is a possibility that an accidental release of radioactive substances into the environment may reach the urban population.

Principal ionizing radiation hazards to urban populations from nuclear reactors are associated with the release of radioactive wastes into the air and water and on to the ground. The release may result in the accumulation of radioactive substances in a biological system that is part of man's food chain.

In addition to knowledge about the physical, chemical, and biological aspects of radioactive substances, persons planning for the use of sources of ionizing radiation in urban areas should have knowledge about the social behaviour of people towards the use of these substances. Only a limited amount of information is available on this subject for use by the planner. A WHO Study Group on the Mental Health Aspects of the Peaceful Uses of Atomic Energy noted that unhealthy social reactions towards the uses of nuclear energy seem to stem from anxiety.<sup>2</sup>

The concern of many people about the potential hazard to health from ionizing radiations has stimulated much research into the effects of these

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1961, No. 225.

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1958, No. 151.

radiations. The WHO Expert Committee on Radiation in 1961,<sup>1</sup> which made a critical review of the technology of health protection from ionizing radiation hazards, noted that protection procedures have been developed to a much greater extent against radiation hazards than against other toxic agents in the environment, and recommended studies for the establishment of criteria for the safe exposure levels to ionizing radiation for both individuals and populations.

In discussing hazards from ionizing radiation, a WHO Expert Committee on Environmental Health Aspects of Metropolitan Planning<sup>2</sup> noted that persons responsible for the planning of metropolitan areas should consider radiation protection problems when deciding the location of nuclear energy reactors and their associated chemical and engineering facilities in or near metropolitan areas. Efficient metropolitan planning can greatly reduce the exposure of the population to ionizing radiations by making full use of properly constructed facilities. One of the tasks of urban planners is to balance the risks and hazards associated with the use of nuclear energy and radioactive substances against the benefits of controlled applications. To be able to attain this delicate balance, comprehensive criteria and guidelines are required.

Modern technology has also developed many devices that emit potentially hazardous nonionizing radiations or microwaves. Many electronic components operated at high voltage have the potential capacity to emit microwaves that can penetrate the human body and may produce heat. The heat-producing capacity of microwaves is the principle upon which microwave ovens operate. These devices are gaining popularity in commercial establishments in the USA and in several other countries because of their speed in cooking food. However, many of them have been improperly designed and constructed and emit significant amounts of nonionizing radiations to the environment.

The use of radiation, both ionizing and nonionizing, in urban areas constitutes a major public health problem that must be considered in all future urban planning. Criteria and guidelines for its safe use are required to avoid both the creation of health problems and the unnecessary limitation of devices that may be highly beneficial to man.

In the development of criteria and guidelines for use in the urban environment of substances and/or processes that can emit ionizing radiation the following basis facts should be considered :

- (1) It is possible for a person to be exposed to severe, damaging doses without being aware of it.
- (2) Ionizing radiation can have deleterious genetic and somatic effects.

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1962, No. 248.

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1965, No. 297, pp. 41-43.

(3) Some effects of ionizing radiation, especially those induced by small doses, do not become apparent until several years later.

(4) It is not known if there is a threshold dose below which there is no effect on man or whether even the smallest dose produces some undesirable effect.<sup>1</sup>

#### 4.7 Control of arthropods and rodents in urban areas

The control of arthropods and rodents has been an essential element of environmental health programmes for many years. The first WHO Expert Committee on Environmental Sanitation defined the term "environmental sanitation" to include specifically the control of such factors as "arthropod, rodent, mollusc, or other alternative hosts of human disease".<sup>2</sup> The third WHO Expert Committee on Environmental Sanitation noted that "in every area in which vector control is a primary need, suitable measures should be taken, but as an integral part of a general programme of environmental sanitation . . . Vector control programmes should be based on a sound knowledge of the ecology of the vector under attack".<sup>3</sup>

A WHO Expert Committee on Public Health Administration called the attention of health planners in tropical and semitropical areas to some public health hazards resulting from the storage of water for domestic use in uncovered storage tanks and from the accumulation of surface water and sillage due to inadequate drainage.<sup>4</sup> Under favourable climatic conditions such water collections can provide suitable breeding places for mosquito-borne diseases such as filariasis, haemorrhagic fever, and malaria.

A WHO Expert Committee on Environmental Change and Resulting Impacts on Health<sup>5</sup> noted that rapid expansion of some urban areas had intensified health problems associated with insect and rodent control and acknowledged the special situation of urban filariasis in some metropolitan areas.

A WHO Expert Committee on Environmental Health Aspects of Metropolitan Planning and Development<sup>6</sup> noted in 1964 that foci of human infection can be created by failure to plan for the control of arthropods and rodents in urban areas but also noted that effective planning of urban areas can reduce breeding areas for arthropods and harbourages and sources of food for rodents. While many former threats to health created by arthro-

<sup>1</sup> World Health Organization Regional Office for Europe (1963) *Public Health Aspects of Protection Against Ionizing Radiation*, Copenhagen (document EURO 234).

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1950, No. 10, p. 6.

<sup>3</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1954, No. 77, p. 14.

<sup>4</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1963, No. 250, p. 7.

<sup>5</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1964, No. 292, pp. 11-15.

<sup>6</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1965, No. 297, p. 50.

pods have been reduced in severity or brought under control, the possibility of resurgence remains ever ominous; the crowding of people into urban areas is creating new potentials for widespread dissemination of some arthropod-borne diseases.

In the past, the control of arthropod-borne diseases was based largely on measures directed simultaneously at the agent, the vector, the host, and the patient. This approach is still valid and necessary, but in environmental health planning the current policy is to bring the vector under control as a first step towards disease eradication.

Criteria for effective urban environmental health planning for the control of arthropod-borne disease should be based on many factors, including comprehensive knowledge of the ecology of the vectors of disease. There is no such thing as a wholly urban environment, and no such thing as a wholly urban species of mosquito.<sup>1</sup> Just as man has adapted himself to some of the changes in the environment that he himself has created, so also arthropods have adapted themselves to some of these man-made changes.

Environmental health specialists should be concerned about, and urban planning criteria should include, the control not only of arthropods that are disease vectors but also of those whose presence in the urban environment may be classified as a nuisance.

Of wild rodents, only rats have become constant commensals of man and live in his dwellings. The control of rats in both the urban and rural environments is important, not only because they may be reservoirs of infectious agents capable of causing human disease, but also because they cause considerable economic loss.

For centuries man has tried to control rats, but at best his efforts have been only partly successful. This failure has been attributed to inadequate methods and lack of knowledge of the biology of rats.<sup>2</sup> From recent biological research, scientists have concluded, however, that extermination of rats is probably impossible. The goal now is effective control to substantially reduce health or economic hazards.

Successful control of rats depends not only on the attainment but also on the maintenance of a physical environment that deprives them of food and shelter. The urban planner and the environmental health specialists have major roles to play in developing a relatively rat-free environment. Behavioural scientists and others also have to assist in enlisting the support of the community in maintaining this situation, once attained.

Environmental health criteria on rodent control in urban areas are not yet available for planners. Comprehensive studies of rodent ecology in the

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<sup>1</sup> Mattingly, P. F. (1963) *Bull. Wld Hlth Org.*, **29**, Suppl. pp. 135-139.

<sup>2</sup> Telle, H. J. (1966) *Rat-free towns*. In: *Seminar on rodents and rodent ectoparasites, Geneva 24-28 October 1966*, Geneva, World Health Organization (document WHO/Vector Control/66.217).

urban environment are urgently needed. These studies should focus on the control of rats, both as a health measure and to eliminate a source of economic loss, and should include the effect of patterns of human behaviour and style of living on the density of the rodent infestation.

#### 4.8 Planning of the residential environment in urban areas

A WHO Expert Committee on the Public Health Aspects of Housing (1961) stressed the role of urban planning in the development of healthful neighbourhoods in the following ways :

- (1) the location and development of neighbourhoods in accordance with human requirements ;
- (2) their protection from degrading industrial effects ;
- (3) the apportioning of scarce manpower, financial, and material resources for optimum benefits ;
- (4) the allocation of resources for housing ;
- (5) orderly and economical changes in land use ;
- (6) the layout of traffic lanes ;
- (7) the provision of facilities in an orderly fashion ;
- (8) the prevention of overloading of community facilities.

A neighbourhood planning guide prepared for the American Public Health Association <sup>1</sup> lists a comprehensive range of criteria that characterize a healthful residential environment. Essentially, they provide for protection from accidents, contagion, pollution, and noise, and ensure adequate daylight, sunshine, ventilation, and opportunities for family and community life, recreation, and aesthetic satisfaction.

In general, however, existing environmental health criteria for residential planning are still inadequate and much study and research are needed to make up the deficiency and to develop new ones.

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<sup>1</sup> American Public Health Association, Committee on the Hygiene of Housing (1948) *Planning the neighbourhood*, Chicago, Public Administration Service (*Standards for healthful housing series*).

## 5. APPLICATION OF EXISTING ENVIRONMENTAL HEALTH CRITERIA

### 5.1 The utilization of existing criteria

While there is a dearth of specific environmental health criteria for use in urban planning at this time when the need for such material is great, there are some general environmental health criteria available that would make the urban planning process more efficient and more successful—although they are not being fully or adequately used. Some of these criteria have been formulated through the evaluation of selected urban planning and development activities in the more developed nations. It is imperative that action be taken to apply these existing criteria—limited as they may be—in all present and future urban planning activities. This is particularly important in the developing countries, which should be able to avoid the errors of omission and commission made by most of the industrialized nations because (a) there is a wealth of information and experience being gathered, studied, and analysed by scientists, practitioners in urban affairs, and “urbanologists” in the more developed nations throughout the world, (b) modern technology and science offer a wide range of possibilities for the development of new urban areas and the rebuilding and renovation of older and existing cities, and (c) there are ample opportunities and resources readily available to make this information accessible to those who have the responsibility for urban planning.

The Scientific Group saw many opportunities for the application of existing criteria in current urban planning. However, it was stressed that there is an immediate need to assemble existing criteria and make them available for general use as quickly as possible to national governments, and public health and urban planning organizations and associations. Such bodies should be encouraged to use existing criteria in national, regional, and urban planning and to identify specific criteria pertaining to their own area. For example, the provision of an adequate supply of potable and palatable water to all urban areas, both in the developing and more developed nations, is an environmental health criterion in urban planning that must be given one of the highest priorities.

In those countries where substantial effort is being given to the development of new urban areas and the renewal and redevelopment of older and existing cities, the national health administrations should make available to those ministries and agencies that are responsible for these activities those basic environmental health criteria that have been identified by this Scientific Group and by other WHO Expert Committees and Scientific Groups.

Specifically, environmental health specialists should assume the initiative to develop and refine statements of specific environmental health objectives for use by planners in comprehensive urban planning.

In the developing nations, where the provision of a safe and adequate community water supply system, a sanitary means of waste water collection and treatment, and a satisfactory means for storm water drainage are so important to the continued growth and development of these nations, efforts should be made to develop guidelines and codes of practice concurrently with the identification of existing basic environmental health criteria. Further, in these developing countries planning should also incorporate detailed considerations for the operation and maintenance of these environmental health facilities and services.

Some concern was expressed about past practices that acknowledged the existence of only certain environmental health criteria for urban planning and ignored others. These have led to conditions in which the solution to one health problem has created other problems. For example, the installation in some of the developing countries of community water supply systems without adequate drainage facilities has created ideal breeding conditions for the common vector of urban filariasis. Environmental health criteria should be considered together and implemented comprehensively.

## 5.2 Special training

The Scientific Group arbitrarily sub-divided discussions on training and manpower development into two principal categories: (1) enlarging the scope of knowledge of presently employed urban planners and environmental health specialists and (2) the training of the younger generation of urban planners and environmental health specialists.

Most practising urban planners were trained under programmes that had little or no content of environmental health matters. Similarly, only a few professional environmental health specialists have had training in urban and regional planning. Each of these two groups needs some training in the other's area of professional competence. This activity could take the form of continuing education, since it is not practical to expect these persons to stop working for 6-12 months to receive this training as full-time students. The Scientific Group reviewed briefly some of the methods of continuing education that appear to merit special consideration. These are as follows:

- (1) 2-4-week seminars or symposia, on a national or regional basis, organized either for mixed groups of professionals or for practitioners of single disciplines, e.g., a seminar or symposium especially designed for urban planners in which the emphasis would be placed on environmental issues.

(2) The development of case studies in which comprehensive involvement of environmental health in urban planning could be illustrated, to be used in formal short-course study programmes, in informal training sessions of brief duration sponsored by a professional agency or association, or for self-study. If this method is used, the case studies must be carefully chosen and must be rather thorough and detailed.

(3) Travelling seminars similar to the Inter-Regional Travelling Seminars on the Public Health and Sanitation Aspects of City Planning conducted in the USSR in 1968 and 1971 to be conducted under various sponsorships and in several geographical areas.

While there are other methods of continuing education to which consideration was given, the three methods listed above seemed to be the most practicable. However, the Scientific Group supports in principle any practicable educational process in which the knowledge of urban planners about environmental health would be increased and/or in which greater understanding of the urban planning process would be acquired by environmental health specialists.

While it was recognized that there are many pressures on education to include selected material in undergraduate, graduate, and postgraduate training, and many hazards in suggesting changes in college and university curricula, it was felt that urban problems are so critical and the need for adequately trained personnel so acute that immediate change is warranted. In general, there is need for inclusion of more material about environmental health issues and problems of urban areas in the curricula of undergraduate, graduate, and postgraduate programmes for physical planners. Similarly, curricula in environmental health at all levels of instruction should include substantial material on planning principles, procedures, and programmes. The Scientific Group felt that questions relating to specific course input should be left to specialists in education.

Another suggested role for WHO to play in the training and development of the required manpower involves the encouragement of and the support for fellowship programmes, including the development, as appropriate, of specific fellowship programmes in environmental health aspects of urban planning. WHO should direct its efforts to those national administrations that have fellowship programmes and to foundations and philanthropic organizations that support educational activities.

### **5.3 The dissemination of information on environmental health criteria in urban planning**

The Scientific Group stressed the need for the efficient dissemination of information on environmental health criteria for urban planning. There is also an urgent need to develop, publish, and distribute guidelines and codes of good practice. While a common set of environmental health criteria for

urban planning can serve the needs of both the developing and the developed countries, separate sets of recommended guidelines and codes of practice should be developed to meet the conditions in the developing and developed countries, respectively.

It was suggested that WHO might consider the establishment of international reference centres, similar to other WHO centres, for the following purposes : (1) to collect and disseminate information on programmes and practices of environmental health measures in urban planning and on the findings of pertinent research studies ; (2) to serve as regional training centres. WHO might also enlist the support of other international organizations for the achievement of these aims.

## 6. THE ESTABLISHMENT OF NEW ENVIRONMENTAL HEALTH CRITERIA FOR URBAN PLANNING

The need to establish new and additional environmental health criteria for urban planning is great. There appear to be ample scientific and technical resources available to develop almost, if not all, of the needed criteria. What seems to be missing is the mechanism to alert research establishments. For example, some of the data collected through the space research programmes of some of the more developed countries may be applicable to urban planning since some of these studies pertain to human responses to controlled environmental sources or to the lack of certain environmental forces.

There is a definite need to study the interaction of multiple environmental factors on man and to determine whether combined responses can be additive or synergistic. The Scientific Group felt there was an urgent need to study the possible relationships between the physical aspects of the residential environment and the mental health and physical and social well-being of the residents. This should determine whether any of the manageable aspects of the physical characteristics of the urban environment contribute to mental stress, strain, and anxiety and if so how and to what extent.

It was suggested that the interdisciplinary methodology of ergonomics be utilized in developing new environmental health criteria for urban planning. Experts in ergonomics feel that the body of knowledge that has been acquired in this field may be useful in the study of man in his urban environment.

It was also suggested that interdisciplinary approaches be used in research studies of human behaviour in urban environments. Such studies could lead to the ultimate development of some very important criteria for urban planning and should provide insight into methods of environmental control and management that could be included in guidelines and codes of good practice.

## 7. PRINCIPAL RECOMMENDATIONS

The Scientific Group felt that the following recommendations merit special consideration :

(1) The development of appropriate environmental health guidelines for the application of environmental health criteria in urban planning. One set of guidelines would be for use in the developing nations and another for use in the more developed nations.

(2) The development of codes of good practice on environmental health provisions for national, regional, and urban planning.

(3) Within each national health administration, the formulation of statements of the immediate and long-range environmental health objectives for that nation for use by urban planners in comprehensive urban planning activities. These statements should be based on available environmental health criteria and should be reviewed and revised periodically.

(4) Special attention should be given to the development of specific environmental health criteria pertaining to the following :

(a) urban climatology (in conjunction with the World Meteorological Organization) ;

(b) the siting of airports ;

(c) the siting, design, and operation of leisure-time, rest, and recreation facilities in or near urban areas ;

(d) the planning of commercial areas in cities and the suburbs ;

(e) the sociophysical planning aspects of residential use of land in urban areas ;

(f) the planning and design of individual dwelling units and of small groups of dwelling units (neighbourhoods) ;

(g) air and water pollution control (supplementary criteria) ;

(h) radiation hazards (supplementary criteria) ;

(i) arthropod and rodent control (supplementary criteria) ;

(j) physiological and mental effects of noise.

(5) The initiation of interdisciplinary studies into the environmental health factors of urban areas that may cause or contribute to the stress, strain, and anxiety of urban residents for the purpose of developing generalized and specific environmental health criteria useful in urban planning.

(6) A review of scientific literature (particularly of published data of the research studies conducted as parts of outer space and underwater living

programmes) for relevant data that would contribute to the formulation of new criteria or the revision of existing criteria of environmental health for urban planning.

(7) The revision of basic curricula of undergraduate, graduate, and postgraduate programmes of study for (a) urban planners, with the incorporation of substantive material on environmental health factors of urban areas, and (b) environmental health scientists, with the incorporation of substantive material on the principles and practices of physical planning and emphasis on the urban planning process.

(8) A study of the immediate and long-term needs of manpower for urban planning activities to identify the needs by professional discipline, e.g., physical planners, sanitary and public health engineers, sanitary doctors, environment physiologists, sociophysical scientists, etc.

(9) The development of training programmes to provide the necessary personnel for urban planning activities, using the data collected in the manpower needs study as a base.

(10) The establishment of continuing education and refresher training courses for practising physical planners and environmental health specialists who are or may be involved in urban planning activities and programmes. The emphasis of these educational efforts would be to broaden the base of knowledge of these persons.

(11) Greater participation of social scientists in environmental health activities that relate to urban planning, particularly in the development of environmental health criteria, so that there may be a substantive base to the planning of the sociophysical factors of the urban environment.

(12) The establishment of international reference centres on environmental health aspects of urban planning, to facilitate the dissemination of basic information to urban planners and environmental health specialists, to aid in the coordination of research activities, particularly at the international level, and to serve as focal points for continuing education or refresher training programmes.

(13) Exploration of the feasibility of using ergonomics as a scientific approach to the development of new environmental health criteria and the refinement or revision of existing criteria for urban planning.

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**Annex****WHO PUBLICATIONS DEALING WITH ENVIRONMENTAL  
HEALTH CRITERIA FOR URBAN PLANNING****1. Urban planning**

WHO Expert Committee on Public Health Administration (1963) *Urban health services*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 250)

WHO Expert Committee (1964) *Environmental change and resulting impacts on health*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 292)

WHO Expert Committee (1965) *Environmental health aspects of metropolitan planning and development*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 297)

**2. Environmental health**

WHO Expert Committee on Environmental Sanitation (1950) *Report on the first session*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 10)

WHO Expert Committee on Environmental Sanitation (1952) *Second report*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 47)

WHO Expert Committee on Environmental Sanitation (1954) *Third report*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 77)

WHO Expert Committee on Environmental Sanitation (1956) *Food hygiene*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 104)

WHO Expert Committee (1970) *National environmental health programmes: their planning, organization, and administration*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 439)

**3. Environmental pollution**

World Health Organization (1968) *Research into environmental pollution. Report of five WHO Scientific Groups*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 406)

**4. Air pollution**

Barker, K. et al. (1961) *Air pollution*, Geneva (*World Health Organization: Monograph Series*, No. 46)

Lawther, P. J. et al. (1962) *Epidemiology of air pollution: Report on a symposium*, Geneva, World Health Organization (*Publ. Hlth Pap.*, No. 15)

WHO Expert Committee on Environmental Sanitation (1958) *Air pollution*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 157)

WHO Expert Committee (1964) *Atmospheric pollutants*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 271)

WHO Expert Committee (1969) *Urban air pollution, with particular reference to motor vehicles*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 410)

WHO Expert Committee (1972) *Air quality criteria and guides for urban air pollutants. Report*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 506)

Katz, M. (1969) *Measurement of air pollutants : Guide to the selection of methods*, Geneva, World Health Organization

*Int. Dig. Hlth Legis.*, 1963, **14**, 187-229 (Air pollution, a survey of existing legislation)

### 5. Water pollution

Christ, W. et al. (1962) *Aspects of Water Pollution control*, Geneva, World Health Organization (*Publ. Hlth Pap.*, No. 13)

WHO Expert Committee (1966) *Water pollution control*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 318)

WHO Expert Committee (1968) *Water pollution control in developing countries*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 404)

### 6. Water supplies

Wagner, E. G. & Lanoix, J. N. (1959) *Water supply for rural areas and small communities*, Geneva (*World Health Organization : Monograph Series*, No. 42)

Cox, C. R. (1964) *Operation and control of water treatment processes*, Geneva (*World Health Organization : Monograph Series*, No. 49)

Adler, P. et al. (1970) *Fluorides and human health*, Geneva (*World Health Organization : Monograph Series*, No. 59)

Dieterich, B. H. & Henderson, J. M. (1963) *Urban water supply conditions and needs in seventy-five developing countries*, Geneva, World Health Organization (*Publ. Hlth Pap.*, No. 23)

WHO Expert Committee on Water Fluoridation (1958) *First report*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 146)

WHO Expert Committee (1969) *Community water supply*, Geneva (*Wld Hlth Org. techn. Rep. Ser.*, No. 420)

World Health Organization (1971) *International standard for drinking water*, 3rd ed., Geneva

World Health Organization (1970) *European standards for drinking water*, 2nd ed., Geneva

## 7. Wastes disposal

World Health Organization (1953) *Design and operation of septic tanks. Third European Seminar for Sanitary Engineers*, Geneva (World Health Organization : Monograph Series, No. 18)

Gloyna, E. (1971) *Waste stabilization ponds*, Geneva (World Health Organization : Monograph Series, No. 60)

Ellis, H. M. et al. (1969) *Problems in community wastes management*, Geneva, World Health Organization (Publ. Hlth Pap., No. 38)

WHO Scientific Group (1967) *Treatment and disposal of wastes*, Geneva (Wld Hlth Org. techn. Rep. Ser., No. 367)

Gotaas, H. B. (1956) *Composting : Sanitary disposal and reclamation of organic wastes*, Geneva (World Health Organization : Monograph Series, No. 31)

## 8. Radiation

Lindell, B. & Dobson, R. L. (1961) *Ionizing radiation and health*, Geneva, World Health Organization (Publ. Hlth Pap., No. 6)

WHO Expert Committee on Radiation (1959) *Effect of radiation on human heredity : Investigation of areas of high natural radiation*, Geneva (Wld Hlth Org. techn. Rep. Ser., No. 166)

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