

**HEALTH
IN
SUSTAINABLE DEVELOPMENT
PLANNING:
THE ROLE OF INDICATORS**

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PREFACE

Concern about the health impacts of the environment and development process has been growing in both the developed and the developing countries of the world. Renewed emphasis has been placed on the need to obtain a better understanding of the links between development, the environment and human health. This is central to sustainable development planning. Both lack of development leading to poverty, and development resulting in overconsumption and the depletion of resources have resulted in severe health and environmental problems world-wide. In order to implement preventive measures, it is necessary to understand the way in which the development process influences health and the environment, and to formulate integrated policies and strategies accordingly.

Indicators have become widely used in many different fields and play a useful role in highlighting problems, identifying trends, and contributing to the process of priority-setting, policy formulation and evaluation and monitoring of progress. Most importantly, indicators can help to simplify a complex array of information concerning the health, environment and development nexus. In this respect, they are important for informing the public and decision-makers about key health and environmental problems, and actions required for their management. Since health, environment and development problems differ in various parts of the world, as do priorities with respect to their management, the types of indicators developed world-wide will also differ, according to the level of decision-making, and the use for which the indicators are intended. It should be emphasized that indicator development is a means rather than an end in itself. Improved decision-making should remain the ultimate goal. Thus, indicators should ideally be developed as part of the overall policy and planning process, if they are to have policy relevance and practical application.

Considerable work on the development of indicators has been done by many organizations, including WHO. This book builds on work done to-date, and lays a basis for the further development and use of health and environmental indicators in sustainable development planning. It is aimed at professionals, policy and decision-makers in the fields of health, environment and development, especially those working at the interface of these issues, who are concerned with the development of indicators as well as with their application. The overall aim is to provide tools and guidance for indicator development and use, and to promote their application and use at all levels, local to global, and in respective sectors.

I would like to acknowledge the large number of individuals who provided useful and thoughtful comments on the various drafts of this book and /or who participated in meetings to review the book. They are named at the end of the book.

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EXECUTIVE SUMMARY

This book deals with the development and use of indicators for health and sustainable development planning. It addresses both technical as well as social aspects of indicator development and use. Elements of the planning process are outlined, and the application of indicators highlighted. Illustrative examples are given where appropriate, and an organizational framework is presented for addressing health-environment-development linkages.

Chapter One of the book gives an overall introduction to health, environment and sustainable development issues of worldwide concern today. Attention is drawn to the wide spectrum of health hazards and to the way in which health is influenced by the environment and development process. A brief account is given of the nature of the health risks associated with environmental and development factors.

Some of the key milestones which have shaped recent thinking and developments in the area of health and sustainable development are then discussed. These have led to an increased recognition of the need to address environment, health and development concerns in an integrated and coordinated way. This is most clearly enunciated in concepts such as “sustainable development” and the need to ensure that the human element, particularly human health, is seen as central to it. Human health is both a determinant and an outcome of sustainable development.

In Chapter Two, the nature and use of indicators in the context of policy- and decision-making is discussed. General characteristics of indicators are highlighted, different types of indicators examined and the concept of “core” indicators and their use introduced.

In Chapter Three, selected international indicator initiatives are highlighted. These include environment and sustainable development indicators, social indicators, housing and urban indicators, and health indicators.

In Chapter Four, criteria for the development and use of indicators are outlined and technical issues to be addressed in their construction are considered. Important methodological aspects to be taken account of, such as data availability and quality, statistical issues, interpretation and risk communication, are highlighted and illustrative examples are given. Emphasis is placed on factors such as the need for clear definitions of indicators and for specifications of measurement variables and methods.

Chapter Five contains an account of intersectoral planning processes in health and sustainable development. Reference is made to health and sustainable development planning initiatives at the national level, as well as to local initiatives. Key issues related to the objectives of intersectoral planning initiatives and partnerships are highlighted.

Chapter Six considers procedural issues relating to the development of indicators in the planning cycle. Indicators in respect of issue identification and action planning, implementation, monitoring and evaluation of plans are discussed and examples given

of ways in which indicators have been used in various elements of the planning cycle.

In Chapter Seven, indicators are discussed in the context of an organizing framework representing health, environment and development linkages, based on an adaptation of the Pressure-State-Response framework first developed by the OECD. Examples are given of indicators associated with the different components of the framework. The indicator lists are not meant to be exhaustive, but to represent a range of conditions and possibilities which can be selected from, in developing indicators for policy and planning purposes. They are meant to encourage an integrative consideration of issues from different perspectives.

Chapter Eight contains examples of indicators associated with various issues and sectors, including those related to housing, transport and agriculture.

Chapter Nine contains a brief summary and gives some pointers to future work needed in the area of indicator development and use.

1

ISSUES IN HEALTH, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT: AN OVERVIEW

In this chapter, an introduction is given to issues in health, environment and sustainable development which are of worldwide concern today. Countries face a myriad of problems relating on the one hand to poverty and a lack of basic services, and on the other to large-scale, rapid industrialization, urbanization and technological development. Problems are often simultaneously local and global. Key milestones which have shaped recent thinking and approaches to dealing with health and environmental problems in the context of sustainable development are highlighted, and the challenges faced by the health sector are outlined.

1.1 THE CHANGING NATURE AND SCOPE OF CONCERNS

The spectrum of health, environment and development hazards has changed considerably over the millennia of human existence. In the past 50 years in particular, the world has seen considerable health gains. For example, childhood mortality and morbidity have been greatly reduced by better control and prevention of infectious diseases. People are living much longer. Between the 1950s and the 1990s, average life expectancy increased from 46 to 65 years, and the gap in life expectancy between rich and poor countries narrowed considerably, from 25 years in 1955 to 13.3 years in 1995 (1).

There have been major advances in science and technology and health and medicine, infrastructure has expanded, literacy has increased, education has improved and incomes and opportunities have increased, especially for women. Yet, despite all this, in many instances the health gaps between and within countries are widening. Not all regions of the world have shared equally in improvements to health. Sub-saharan Africa, the world's poorest region, still has average life expectancies far below those of the wealthiest countries. Underlying much of this unequal burden of disease is the fact that environmental factors are a major contributor to sickness and death throughout the world, especially in the poorest regions (2).

Old and New Problems Occurring Simultaneously

Age-old public health hazards such as inadequate and unsafe food and water, microbiological contamination of the environment and poor sanitation and environmental hygiene are still prevalent. In addition, new environment and

development problems have emerged, some of which appear to threaten the entire ecosystem. While factors associated with the development process and the changing use of technology have resulted in considerable gains to people throughout the world, they have also presented additional threats to people's health.

Many of the "newer" hazards associated with chemical contamination of the environment are as significant for developing countries as they are for industrialized countries. Countries nevertheless differ with respect to the spectrum of health, environment and development problems with which they have to deal and to which they give priority. The level of economic development and the policy choices of individual countries are important factors determining the nature of the problems faced and the ways in which they are addressed.

In industrialized countries, typical health and environmental problems include outdoor air pollution, radon in homes and schools, the "sick building" syndrome, toxic chemicals in drinking-water, non-ionizing electromagnetic radiation and pesticide residues in food. In developing countries, health and environmental problems are often related to poverty and arise largely as a result of such factors as rapid, uncontrolled urbanization and agricultural and land-use practices. In addition to hazards related to pollution, vector-borne environmental diseases may be prevalent as well as health and environmental problems associated with a lack of proper shelter, water and sanitation or poor food hygiene.

Developing countries thus have to deal simultaneously with problems due to a lack of basic services and facilities, with the impact on health of large-scale, rapid industrialization, urbanization and technological development. Indeed, it is often difficult to distinguish traditional risks from new and emerging ones. For example, pesticides and faeces may contaminate the same water supplies and air pollution may stem simultaneously from burning dirty household fuels and industrial use of fossil fuels. Rapid population growth makes it more difficult to solve this load of problems, which outstrips a country's economic development, retards social development and makes excessive demands on services, resources and the capacity of the increasingly fragile environment (3).

It is becoming readily apparent that the capacity of the environment to meet growing human needs is limited. This makes it crucial to improve our understanding of the complex relationships between the development process, environmental capacity and human health.

From Local to Global Dimensions

Virtually every aspect of the environment may affect physical or mental health in some way, either positively or negatively. This is true regardless of the level of development at which problems manifest themselves. Problems may be related to both the direct pathological effects of various chemical, physical and biological agents and the more indirect effects on health and well-being of the broad physical and social environment (4), which includes housing, urban development, land use, transport, industry and agriculture.

Health concerns associated with air and water pollution, water supply and sanitation, waste disposal or chemicals and food may be particularly relevant at the local or micro-level (for example, lead in household dust or environmental tobacco smoke), or may be important at the regional or global level (for example, depletion of the ozone layer, global climate change, long-range transport of air pollution or marine pollution).

The problems to be dealt with are often simultaneously global and local. Global economic activities, escalation of travel and trade and the changing use of technology all have significant implications for health and the environment. Indeed, erosion of life-support systems at the global level has become a serious, pressing public health issue which should be addressed at various tiers of government in an overall framework of sustainable development.

From Rural to Urban Dimensions

Problems may differ in urban, as opposed to rural, environments. With massive urbanization occurring on a global scale, international interest and concern has centered increasingly on the state of the environment and human health in cities. It is estimated that by the year 2025 over five thousand million people will be living in cities. In the developing countries of the world, already more than 200 cities have populations of one million or more (5).

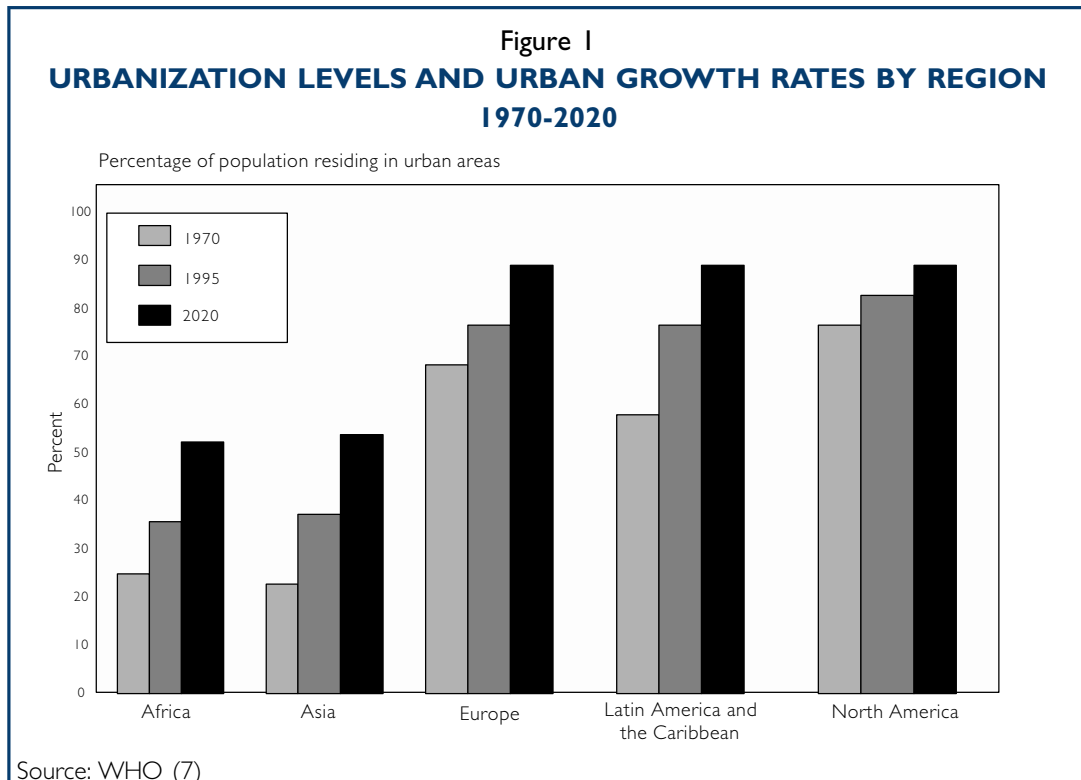
It has become evident that, although living in cities has many positive benefits, related, for example, to increased job opportunities and the provision of essential services and facilities, many environment, health and development problems have reached near-crisis dimensions in cities all over the world. Urban growth has exposed populations to serious environmental hazards and has outstripped the capacity of municipal and local governments to provide even basic health services. In 1990, at least 600 million people in the urban areas of developing countries were living under life- and health-threatening conditions (6).

Cities have a significant impact on the broader hinterland and global environment. While the lines that separate a city, country or region are becoming increasingly blurred, it is also clear that the fate of cities will have a major influence on the fate of nations and of the planet (5).

Poverty

Despite the unprecedented creation of wealth world-wide in the past two decades, the number of people living in absolute poverty is growing steadily (1). Poverty remains the number one killer, with the poor bearing a disproportionate share of the global burden of ill-health. The poor live in unsafe and overcrowded housing, often in underserved rural areas or peri-urban slums which lack access to safe water or to sewerage. They are also more likely than the wealthy to be excessively exposed to pollution, traffic and industrial and other risks at home, at work or in their communities. They are more likely to consume insufficient food or food of poor quality.

Even in rich countries, the poor suffer worse health than do the better-off (2). Poor



children are particularly affected – in the poorest regions of the world, one in five children dies before his or her first birthday, mostly from environment-related diseases such as acute respiratory infections, diarrhoea and malaria (7). Not only are children more heavily and frequently exposed to threats to their health in the environment, but they are also more vulnerable to the ill-effects on health. For example, in the USA and parts of Europe, lead poisoning illustrates the unequal burden of risk borne by poor inner-city children, who are more heavily exposed to sources of lead in and around the home and are also more affected by the toxicity of lead.

Some of the major factors that affect health in the twenty-first century are highlighted in Box 1.

Box 1
FACTORS AFFECTING HEALTH IN THE TWENTY-FIRST CENTURY

- Widespread absolute and relative poverty
- Demographic changes: ageing and the growth of cities
- Epidemiological changes : continuing high incidence of infectious diseases, increasing incidence of noncommunicable diseases, injuries and violence
- Global environmental threats to human survival
- New technologies: information and telemedicine services
- Advances in biotechnology
- Partnerships for health between the private and public sectors and civil society
- Globalization of trade, travel and spread of values and ideas.

Source: WHO (1)

1.2 ESTIMATING THE HEALTH RISKS

While the many hazards present in the environment today may have various effects on human health, the global burden of disease attributable to these hazards cannot be quantified with any degree of confidence. In many parts of the world, the infrastructure for monitoring and for health surveillance is poorly developed, so that the numbers of people at risk are largely unknown. In the case of environmental pollution, the links to health are often uncertain and are masked by other effects, such as social deprivation and lifestyle.

Over the years, several incidents of severe poisoning or accidents have occurred, including water pollution by heavy metals such as mercury and cadmium which led to outbreaks of Minimata disease and Itai Itai disease. Episodes of air pollution, too, have resulted in large numbers of deaths, such as the famous London smog episode of 1952, in which an excess of 4000 people died. Accidents such as those that took place in Bhopal (India) and Chernobyl (Ukraine) also resulted in widespread death and disease, including psychosocial ill-health effects. Similarly, the forest fires in South-East Asia in the 1990s resulted in high levels of air pollution and associated mortality and morbidity.

It is currently estimated that around 1.5 million deaths in children under the age of five occur annually as a result of diarrhoeal disease, and that there are several thousand million diarrhoeal episodes each year. Diarrhoeal diseases are five to six times more common in developing countries than in developed countries (7). Such diseases are closely related to poor sanitation and hygiene and to the resultant contamination of food and water. It is estimated that over one billion people are without access to improved water supply, and that about two-and-a-half billion people lack access to improved sanitation. Today, in some 20 countries, mostly in Africa, three-quarters or more of the population do not have access to basic sanitation (7).

People may be exposed to high levels of air pollution in developing countries where burning of biomass and use of fuels such as coal and kerosene for cooking and heating still prevail. This is particularly true of China, India and sub-saharan Africa. Indeed, the overwhelming proportion of the some three million deaths from air pollution which result globally each year occurs in developing countries, mainly due to indoor air pollution associated with domestic fuel use (7).

Acute respiratory infections are a leading cause of death among children under the age of five, killing more than four million people per year and accounting for over 8% of the global burden of disease (7). The indoor environment is an important risk factor in this regard, particularly pollution from domestic fuel-burning and overcrowding.

Large numbers of people are affected by various other diseases which have their roots in the environment. For example, several hundred million people are infected with malaria each year (resulting in over one million deaths), and several thousand million are infected with intestinal parasites.

Table 1 gives an indication of the relative contribution of environmental exposures to the global burden of disease and injury. These estimates are based on the concept of

disability-adjusted life years (DALYs), which expresses the health loss due to a combination of death, disease and disability. Each DALY indicates the loss of a year of healthy life, i.e. the time lived with a disability or time lost through premature death (8). It is estimated that about 23% of the world's total DALY burden is associated with environmental factors. This is a rough estimate, however, and more work is needed to gain a better understanding of the links between environment, health and development and to quantify the contribution of various environmental and development factors to death, disability and ill-health.

Table I
PROPORTION OF GLOBAL DALYS ASSOCIATED WITH ENVIRONMENTAL EXPOSURES - 1990

	Global DALYs (thousands)	Environmental fraction (%)	Environmental DALYs (thousands)	% of all DALYs (all age groups) (age 0-14 years)	
Acute respiratory infections	116 696	60	70 017	5	4.5
Diarrhoeal diseases	99 633	90	89 670	6.5	6.1
Vaccine-preventable infections	71 173	10	7 117	0.5	0.49
Tuberculosis	38 426	10	3 843	0.3	0.04
Malaria	31 706	90	28 535	2.1	1.8
Injuries - unintentional - intentional	152 188 56 459	30 N.E.	45 656 N.E.	3.3	1.6
Mental health	144 950	10	14 495	1.1	0.08
Cardiovascular diseases	133 236	10	13 324	1	0.12
Cancer	70 513	25	17 628	1.3	0.11
Chronic respiratory diseases	60 370	50	30 185	2.2	0.57
Total these diseases	975 350	33	320 470	23	15.4
Other diseases	403 888	N.E.	N.E.		
Total all diseases	1 379 238	(23)	(320 470)		

N.E.: Not Estimated

Source: WHO (7)



1.3 LINKING HEALTH WITH ENVIRONMENT AND DEVELOPMENT

Irrespective of the precise contribution of the environment to ill-health in the world, concerted action is needed to reduce the health impacts. The factors that contribute to problems of health and the environment are manifold and complex, but fundamental are inadequate attention to health in development policy and practice, lack of coordinated management and insufficient inter-sectoral collaboration (9). The root causes of problems are often related to the way in which development at large has proceeded, with little attention paid to the effects on the environment and health of policies, plans, strategies and projects.

From recent international meetings held since Rio'92, it has become evident that health issues are an increasingly important item on the broad environment and development agenda, and that environmental issues are receiving more prominence on the public health agenda (10).

In 1987, the World Commission on Environment and Development linked the issue of environmental protection to the topic of economic growth and development. The urgency of environment and development problems led subsequently to the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil, in 1992. This Earth Summit, attended by representatives from 179 countries, was the largest gathering of Heads of State in world history and led to the adoption of Agenda 21, a global programme of action for achieving sustainable development in the twenty-first century and beyond (11).

Sustainable development has been defined as “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (12). Agenda 21 highlights, among many aspects, the need for more appropriate management of human settlements, and places particular emphasis on the need to take health considerations into account in planning for sustainable development.

The theme of human settlements was re-emphasized at the Habitat II meeting held in Istanbul, Turkey, in June 1996 (13), which focused attention on cities, highlighting their importance in the light of the rapid urbanization prevailing throughout the world. Indeed, several international conferences have drawn attention to the importance of urban environments and sustainable development, including the 1994 Global Forum meeting held in Manchester, United Kingdom. In parallel with these developments, several movements have emerged over recent years focusing on the need to examine local environmental conditions and the way in which local environmental initiatives can contribute to improved environmental management and health.

A growing awareness of the links between development, health and the environment is also evident from the recent history of the public health movement. In 1986, with the launch of the Ottawa Charter on Health Promotion (14), the need to develop supportive environments for health was highlighted, and emphasis was placed on viewing health in a broader development perspective. In particular, the Charter stressed

the need to look at the various elements known to improve health as part of an integrated whole and to look outside as well as within the health sector when devising strategies for improving health.

This theme was expanded at the Sundsvall Conference on Supportive Environments for Health held in Sweden in 1991, which examined the role played by various sectors in influencing environment and health conditions and linkages, viewing how health and environmental considerations could best be incorporated in sectoral planning (15). The need to consider the settings in which health is created, such as housing and the work environment, was held to be vitally important.

The WHO Commission on Health and the Environment was convened in 1990 (16) and provided key input for the subsequent Earth Summit. The central relevance of the human factor to the concept of sustainable development was stressed in the preamble to the Rio Declaration, as follows: *“Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature”* (11). Chapter 6 of Agenda 21 takes this principle further by emphasizing the fundamental commitment within sustainable development of “protecting and promoting human health”.

There is thus growing recognition that economic development, management of the environment and protection of public health must be addressed together in an integrated way. While the environmental movement has highlighted the aspect of sustainability, the health movement has laid special stress on the issues of social justice, equity and human development. Not only are healthy people needed to ensure development, but also health is not possible without development.

1.4 NEED FOR HOLISTIC APPROACHES

The above discussion demonstrates an increasing need to form partnerships, to work across sectors such as the environment, transport, energy and housing, to involve communities more closely in decision-making and to devolve decision-making to the lowest possible level. Inter-sectoral efforts are particularly important for addressing complex, interrelated problems, the determinants or solutions of which may lie beyond the direct control of the health sector (9). Optimal use must be made of limited resources, and the expertise, knowledge and experience of all relevant sectors of society must be used in order to develop solutions that are sustainable and implementable.

While some problems are shared globally and transnationally, each country, region and community also faces its own unique problems, the solutions to which will be affected by factors such as resources, customs, institutions and values (17). This implies a need for harmonized global, national and local strategies. The strategies to be created should address underlying systemic problems rather than symptoms and incorporate economic, health and environmental dimensions in the design of projects and services, fully engaging all relevant interest groups and service users (18).

Chapter 6 of Agenda 21 specifies that countries should set priorities for actions based on cooperative planning by various levels of government, non-governmental organizations and local communities. Such planning, orientated to the prevention of health and environmental problems and involving all levels and sectors of communities, is essential for achieving “Health for All” and sustainable development.

Role of the Health Sector

Although much progress has been made in recent years in the development of comprehensive health and environmental policies and strategies, it is also true that many countries throughout the world have been relatively slow to develop these. This has been due partly to the fact that there are many gaps in knowledge and perceptions of insufficient evidence on which to act. It is also due to the very real challenges to the health sector of addressing policy needs with respect to new and expanded areas such as energy, agriculture, industrialization and advanced technology. Nevertheless, there is a growing appreciation of the key role that the health sector can play in helping to ensure that the policies and strategies of various sectors and organizations contribute positively to health protection and promotion.

Agenda 21 presents an opportunity for health authorities to strengthen their influence in both national and local planning and to reverse the trend of environmentally damaging and health-threatening development. A number of countries have taken initiatives since the Earth Summit to include a stronger health focus in national planning for sustainable development (see Chapter 5). Measures for incorporating health and environmental issues in national plans and programmes have varied from country to country, depending on planning mechanisms, the current status of the sustainable development programme and the way in which planning responsibilities are divided. In some countries, plans for health and the environment have been prepared for inclusion in national plans for sustainable development, while in others sectoral plans have been reviewed and modified to address health and environmental concerns. Agenda 21 also attached great importance to the role of local governments in fostering sustainability. Indeed, Agenda 21 called upon local governments to enter into a dialogue with their citizens, local organizations and private enterprises and to adopt a “Local Agenda 21” plan of action.

The emergence of complex environmental and health systems has made it necessary to define more clearly the responsibility of the health sector in helping to ensure that the activities of all sectors and organizations contribute positively to health protection and promotion. Although environment, health and development concerns should form part of the responsibility of all sectors, the health sector has special responsibilities, which are highlighted in the box below.

Box 2

HEALTH SECTOR RESPONSIBILITIES

- Monitoring overall health status, ensuring that health is monitored at the city, neighbourhood or district level and that intra-urban and intra-district differences are detected (this is important in terms of shifting the focus of regulatory control in many countries from low risks which often affect only relatively small percentages of the population)
- Estimating the contributions of various environmental and social factors to health problems, by using improved indicators of the relationship between health and living conditions to support decision-making
- Analyzing environmental and social health needs and requirements in various development sectors that are significant for health, such as housing, local government, transport and industry, including consideration of the health opportunities offered by each sector
- Formulating health and environmental policies in partnership with relevant sectors
- Advocating, facilitating and fostering the inclusion of health issues in the work of competent agencies, organizations and communities at all levels and generally promoting health and the environment
- Supporting health and environmental service delivery and providing such services as are appropriate at various tiers of government
- Supporting the development of research that may be necessary to improve understanding, assessment and management of health risks
- Providing technical support and guidance in policy and planning, evaluation and capacity development.

Source: adapted from von Schimding (9)



2

THE NATURE AND USE OF INDICATORS

This chapter introduces the concept of indicators in the context of policy and decision-making. As indicated in the previous chapter, health, environment and development problems differ throughout the world, as do priorities in respect of their management. Here, the nature of indicators is discussed in relation to information needs, and their general characteristics are highlighted. Various types of indicators are discussed, and the concept of core indicators is introduced.

2.1 DATA AND INFORMATION NEEDS

Wide-ranging reforms may be needed to enable the health sector to fulfil some of its broader responsibilities, listed in Box 2. Nevertheless, for such functions to be carried out, information is needed by decision-makers and the public. This is necessary to identify existing problems, set priorities, develop and evaluate policies and plans, guide research and development, set standards and guidelines, monitor progress and inform the public.

Chapter 40 of Agenda 21, which addresses information required for decision-making, states that “*in sustainable development, everyone is a user and provider of information in the broad sense*” (11). Decision-makers and the public must have ready access to accurate information on the health hazards associated with development and the environment. This information must be conveyed in a readily comprehensible way, but with due regard for inherent complexities and uncertainties in the data.

An abundance of information (of varying quality) is often available from monitoring and surveillance programmes, especially in industrialized countries, but this information may not always be in a form relevant for decision-makers to set policies. It may be of limited use for informing the public and decision-makers about key health and environmental problems and their causes, or about actions that may be required for their management.

Providing information that is relevant to policy-making within constraints of time and other factors, and in a form which all those involved can appreciate and accept is a major challenge, requiring the selection of information that is directly relevant to the task at hand and necessitating translation of this information into a consistent, coherent form.

Indicators can play an important role in turning data into relevant information for decision-makers and the public. In particular, they can help to simplify a complex

array of information about the health–environment–development nexus. They provide a “synthesized” view of existing conditions and trends which can be used in decision-making. They thus play an important role in improving communication with the public and decision-makers, and may contribute to improved management and policy development.

One of the most important stimuli for indicator development in the field of health and the environment was adoption of Agenda 21 and the emergence of sustainable development as a guiding principle for policy development. Chapter 40 of Agenda 21 (mentioned above) states that indicators of sustainable development should be developed to provide a solid basis for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems (11). It states that “*While considerable data already exists, as the various sectoral chapters of Agenda 21 indicate, more and different types of data need to be collected at the local, provincial, national and international levels, indicating the status and trends of the planet’s ecosystem, natural resources, pollution and socioeconomic variables*”.

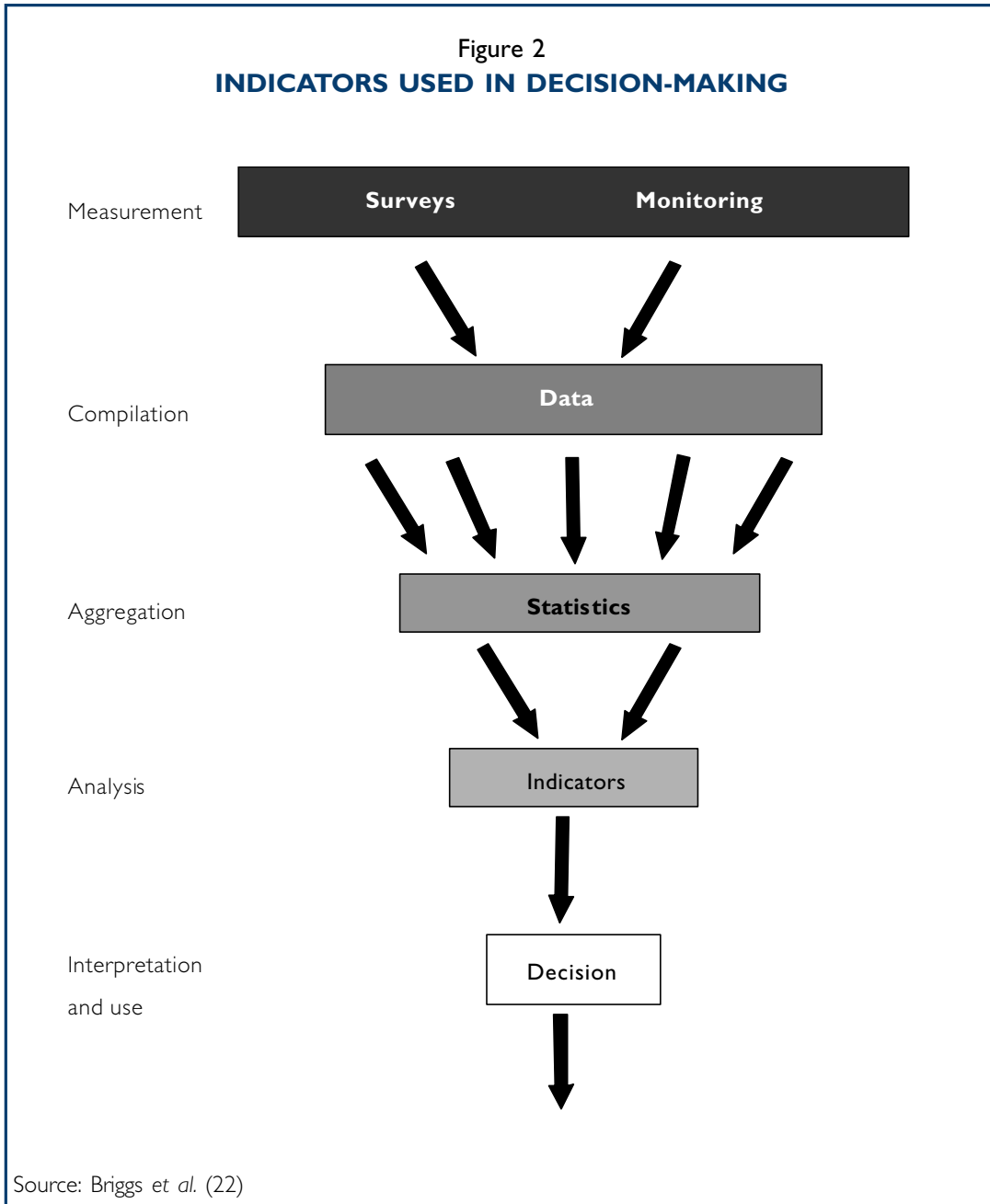
2.2 DEFINITIONS AND CHARACTERISTICS OF INDICATORS

The term “indicator” is derived from the Latin “indicare”, which means to announce, point out or indicate. Chambers Dictionary defines an indicator as “...*something that provides an indication, a pointer...any device for exhibiting conditions for the time being*”. The Organisation for Economic Co-operation and Development (OECD) has defined an indicator as “*A parameter, or a value derived from parameters, which points to/provides information about/describes the state of a phenomenon/environment/area with a significance extending beyond that directly associated with a parameter value*” (19).

Others have defined an indicator as “*a piece of information which is part of a specific management process, and has been assigned a significance beyond its face value*” (20). The Scientific Committee on Problems of the Environment (SCOPE) described indicators in terms of two key characteristics: they quantify information so that its significance is more readily apparent, and they simplify information about complex phenomena so as to improve communication (21).

Briggs *et al.* (22), building on these definitions, defined an environmental health indicator as “*An expression of the link between environment and health, targeted at an issue of specific policy or management concern and presented in a form which facilitates interpretation for effective decision-making*”. Embodied in this definition is the concept of a link between a factor in the environment and a health outcome.

However they are defined, indicators form part of information systems, but they are distinct from statistics and primary data in that they represent more than the data on which they are based. For example, measurements of various aspects of environmental



quality result in raw data, such as hourly air pollution levels, which might then be aggregated and summarized to provide statistics such as 24-hourly mean air pollution levels. The statistics might subsequently be analysed, re-expressed and combined in the form of indicators (for example the number of days on which air quality guidelines are exceeded), which can then be fed into the decision-making process.

Indicators thus give data added value by converting them into information which is of direct use to the decision-maker, helping to shed light on a problem. They have become well-established and are widely used in many fields, from economics to ecology to health, and can be used at the global, regional, national, local or neighbourhood levels, as well as at the sectoral level (23).

One example of an indicator is the gross domestic product (GDP), which is a way of assessing aspects of economic development in a country. The infant mortality rate is an indicator of the health status of a community. The rise in ambient temperatures worldwide is an indicator of climate change. The number of public complaints received by a local authority is an indicator of the level of satisfaction with the quality of services provided. In the field of ecology, the presence or absence of an ‘indicator species’ can be used to assess the conditions that prevail in an ecosystem.

Composite Indicators

Indicators may be specific or they may be composite, which means that they condense a wide range of information on different (but related) phenomena into a single measure or index, such as the human development index, which combines information on life expectancy at birth, educational level and level of income. A “gender-related” development index has been elaborated by UNDP. In practice, however, the construction of such composite indicators is challenging, and high levels of competence in statistics and measurement are needed in order to weight and combine different variables. In addition, the choice of components and the manner in which they are weighted may be largely subjective. It can be difficult to test or verify composite indicators, since they may not relate to specific, measurable conditions. Confusion may arise if the effects of the individual components are variable and if significant trends in an underlying component are masked by other components. Such indices may not be readily understood by the public, who could feel that their actions had no effect on the indicator (24).

Composite indices can nevertheless be useful in summarizing data and information for decision-makers and may be particularly valuable for drawing comparisons between countries. For example, in the construction of indicators for global climate change, the individual greenhouse gases contributing to global warming can be weighted by their global warming potential or health-absorbing capacity and can be expressed in terms of “carbon dioxide equivalents”. A similar approach has been adopted in a weighting scheme for ozone-depleting gases (21). Many air quality indices have been devised, such as the pollutant standard index developed in the USA in the 1970s, and water quality indices that make it possible to aggregate variables associated with water use. The human development index has been widely used for inter-country comparisons.

In the field of health, the DALY referred to in Chapter 1 (Section 1.2) is an example of a composite measure of the burden of disease which is based on the concept of disability-adjusted life years, combining the years of healthy life lost as a result of premature death, disability or disease (8).

Indicator Typologies

Indicators can be classified in many ways, for example according to whether they are concerned with impacts, process or outcomes or whether they are quantitative (involving numerical measurements) or qualitative (for example involving people’s

opinions or perceptions). The European Environment Agency (EEA) has developed a useful typology of indicators (25).

A descriptive indicator is defined as one that indicates what is happening to the environment or to human health (for example, emissions and concentrations of pollutants), while a performance indicator is linked to a reference value or policy target, illustrating how far the indicator is from the desired level. Performance indicators of the achievement of agreed targets and goals have been extensively used in the private sector.

Box 3

THE EUROPEAN ENVIRONMENT AGENCY (EEA) TYPOLOGY OF ENVIRONMENTAL INDICATORS

Type A

Descriptive indicators of what is happening to the environment or human health, for example emissions and concentrations of pollutants

Type B

Performance indicators linked to a reference value or policy target, illustrating how far the indicator is from a desired level

Type C

Efficiency indicators illustrating the efficiency of production and consumption processes, for example energy consumption per unit of output

Type D

Total welfare indicators which aggregate together economics, social and environmental dimensions to illustrate whether, overall, welfare is increasing

Source: U.K. Department of Environment, Transport and Regions (25)

Indicators that are primarily descriptive can be useful in obtaining baseline information on which to formulate subsequent policy options and plans, and to assess trends. At all levels (global, regional and local), indicators that describe the overall state (quality) of human health and the environment, and that highlight the factors that affect environmental quality and human health can be useful, as they can provide an overview, snapshot or profile of environmental and health conditions, thereby demonstrating trends. Reports on the state of health and the environment have often served as a basis for the subsequent development of health and environmental action plans.

Indicators derived by community groups can be more useful for community-based monitoring of locally relevant issues than national or global indicators in which the link with local activities is often remote. Locally derived indicators can be used as a way of building capacity in communities and decision-making bodies, enabling them to play a more active role in assessing environmental and health conditions and recommending subsequent remedial actions (see also Chapter 6).

Indicators of the various policy responses needed to address problems can also be useful. In developing countries, where the database required to construct indicators

may be limited but the problems (and solutions) well known, it may be more appropriate to focus on the development of response, or action, indicators, than on those based on data from extensive monitoring programmes (21).

Some indicators are more relevant to national or global issues (for example health aspects of climate change), while others are more relevant locally (for example drainage or solid waste disposal). Many issues, such as management and control of air pollution, require action across various tiers of government: the setting of standards may be relevant at the national level, monitoring and control at the local level and assessment of trends in greenhouse gas emissions in relation to climate change at the global level.

The issues highlighted in Table 2 below could be particularly relevant at the global, national and local levels, respectively, although there are no rigid boundaries and the situation varies from one setting to another. The roles and responsibilities of different tiers of government in managing various health and environmental problems, the degree of decentralization of powers and functions, and factors such as data availability and quality will influence the extent to which data for indicators at different levels should be examined.

Table 2
EXAMPLES OF HEALTH AND ENVIRONMENTAL MANAGEMENT CONCERNS AT LOCAL, NATIONAL AND GLOBAL LEVELS

Local	National	Global
<ul style="list-style-type: none"> • Dust control • Noise control • Solid waste disposal • Water and sanitation supply • Pest control 	<ul style="list-style-type: none"> • Hazardous waste management policy • Regulation of toxic chemicals • Food safety policy • Ambient air pollution standards (major industrial/mobile sources) 	International conventions and agreements: <ul style="list-style-type: none"> • Climate change • Transboundary pollution • Ozone depletion • Acid deposition • Marine pollution

2.3 CORE INDICATORS

There has been much debate on, and interest in the concept of a set of “core” indicators which can be used on a global basis to examine overall trends in health and environment. Opponents of the concept have argued that health and environmental problems and priorities for their management differ significantly in various regions of the world, as do monitoring and analytical capabilities and resource availability. Problems of standardizing definitions and difficulties in ensuring quality control on a worldwide basis are further complicating factors.

Yet most countries, regardless of their level of development or of other socio-political or cultural realities, must deal with certain problems of universal significance (see Table 2 above for some examples). As indicated, whilst the dimensions of these problems differ from one country to another and within countries, universally applicable indicators could be valuable for improving shared knowledge about factors that affect the state of the global environment. Common sets of indicators have other obvious benefits, as they allow aggregation at local, country, regional and global levels and also provide momentum to countries in attaining rigorous standards. Global, regional or national reporting requirements may exist under international treaties or for the targets set by various intergovernmental bodies; these also may necessitate internationally standardized indicators. Hence, standardized indicators, including frameworks, concepts, definitions, procedures and methods have an important place.

Indicators should not however place unnecessary reporting burdens on countries. Efforts by government departments, agencies, non-governmental organizations, civil society and the donor community should be coordinated and should aim at strengthening data collection and management. Existing data should be drawn upon as far as possible, with due regard for their limitations. Where user needs are similar, indicators should be harmonized.

A REGIONAL APPROACH TO ENVIRONMENTAL HEALTH MONITORING: EASTERN MEDITERRANEAN COUNTRIES

Several regional conferences and seminars in the Eastern Mediterranean Region have highlighted the fact that a lack of reliable data on environmental health is a major constraint on the effective development of environmental health programmes. The Beirut Declaration of Action for a Healthy Environment regarded regional collaboration in environmental health information systems as an urgent and important issue.

With support from the WHO Regional Office for the Eastern Mediterranean (EMRO) and the International Development Research Centre (IDRC), the WHO Regional Centre for Environmental Health Activities undertook a number of initiatives to develop country-specific environment and health indicators and is encouraging the development of a set of core indicators for information exchange at the regional level. As a result of a series of studies and regional meetings, the following set of environmental health indicators was proposed for application in the Eastern Mediterranean Region:

Water supply

- Proportion of population with access to an adequate amount of safe water in the dwelling or within a convenient distance from the dwelling

Sanitation

- Proportion of population with access to a sanitary facility for human excreta disposal in the dwelling or within a convenient distance from the dwelling

(cont'd)

Solid waste

- Proportion of houses served by regular waste removal services

Food safety

- Incidence of outbreaks of foodborne poisoning per year

Air pollution

- Annual number of deaths among children under the age of five from acute respiratory infections
- Percentage of population in non-electrified dwellings

Health-care waste

- Proportion of untreated health-care waste

Source: Atallah & Khan (26)

3

INTERNATIONAL INDICATOR INITIATIVES

This chapter highlights selected international indicator initiatives. This includes environment and sustainable development indicators, social indicators, housing and urban indicators, and health indicators developed by various international bodies.

3.1 ENVIRONMENT AND SUSTAINABLE DEVELOPMENT INDICATORS

In the early to mid-1990s, organizations such as the OECD (19), SCOPE (27), UNEP/RIVM (20), the World Bank (28), the World Resources Institute (29) and others became involved in the development of indicators to monitor environmental trends. The OECD approach has been to develop indicators for assessing countries' environmental performance, and the World Resources Institute has devised indicators for measuring and reporting on the performance of environmental policy in the context of sustainable development (23).

Many inter-governmental and non-governmental organizations and various countries have drawn up indicators of sustainable development (see Chapter 6 for further details). The United Nations Commission on Sustainable Development has been instrumental in coordinating the development and testing of such indicators. To date, it has compiled about 130 indicators of social, economic, environmental and institutional aspects of sustainable development, which have been classified according to whether they are "driving force" indicators representing human activities, processes and patterns with an impact on sustainable development, whether they indicate the 'state' of sustainable development, or whether they are indicators of "response" to policy options and to changes in the state of sustainable development (30). These indicators are being tested at the national level throughout the world, and it is anticipated that they will be used in national decision-making, following adaptation and modification. A core set based on the policy priorities of Agenda 21 will be presented for endorsement to the Commission on Sustainable Development.

Table 3
SELECTED SUSTAINABLE DEVELOPMENT INDICATORS

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
CATEGORY: SOCIAL			
Chapter 3: Combating poverty	<ul style="list-style-type: none"> • Unemployment rate 	<ul style="list-style-type: none"> • Head count index of poverty • Poverty gap index • Squared poverty gap index • Gini index of income inequality • Ratio of average female wage to male wage 	
Chapter 5: Demographic dynamics and sustainability	<ul style="list-style-type: none"> • Population growth rate • Net migration rate • Total fertility rate 	<ul style="list-style-type: none"> • Population density 	
Chapter 36: Promoting education, public awareness and training	<ul style="list-style-type: none"> • Rate of change of school age population • Primary school enrolment ratio (gross and net) • Secondary school enrolment ratio (gross and net) • Adult literacy rate 	<ul style="list-style-type: none"> • Children reaching grade 5 of primary education • School life expectancy • Difference between male and female school enrolment ratios • Women per hundred men in the labour force 	<ul style="list-style-type: none"> • GDP spent on education
Chapter 6: Protecting and promoting human health		<ul style="list-style-type: none"> • Basic sanitation: Percent of population with adequate excreta disposal facilities • Access to safe drinking water • Life expectancy at birth • Adequate birth weight • Infant mortality rate • Maternal mortality rate • Nutritional status of children 	<ul style="list-style-type: none"> • Immunization against infectious childhood diseases • Contraceptive prevalence • Proportion of potentially hazardous chemicals monitored in food • National health expenditure devoted to local health care • Total national health expenditure related to GNP

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
Chapter 7: Promoting sustainable human settlement development	<ul style="list-style-type: none"> • Rate of growth of urban population • Per capita consumption of fossil fuel by motor vehicle transport • Human and economic loss due to natural disasters 	<ul style="list-style-type: none"> • Percent of population in urban areas • Area and population of urban formal and informal settlements • Floor area per person • House price to income ratio 	<ul style="list-style-type: none"> • Infrastructure expenditure per capita
CATEGORY: ENVIRONMENTAL			
Chapter 18: Protection of the quality and supply of freshwater resources	<ul style="list-style-type: none"> • Annual withdrawals of ground and surface water • Domestic consumption of water per capita 	<ul style="list-style-type: none"> • Groundwater reserves • Concentration of faecal coliforms in freshwater • Biochemical oxygen demand in water bodies 	<ul style="list-style-type: none"> • Waste-water treatment coverage • Density of hydrological networks
Chapter 17: Protection of the oceans, all kinds of seas and coastal areas	<ul style="list-style-type: none"> • Population growth in coastal areas • Discharges of oil into coastal waters • Releases of nitrogen and phosphorus to coastal waters 	<ul style="list-style-type: none"> • Maximum sustained yield for fisheries • Algae index 	
Chapter 10: Integrated approach to the planning and management of land resources	<ul style="list-style-type: none"> • Land use change 	<ul style="list-style-type: none"> • Changes in land condition 	<ul style="list-style-type: none"> • Decentralized local level natural resource management
Chapter 12: Managing fragile ecosystems: combating desertification and drought	<ul style="list-style-type: none"> • Population living below poverty line in dryland areas 	<ul style="list-style-type: none"> • National monthly rainfall index • Satellite derived vegetation index • Land affected by desertification 	
Chapter 13: Managing fragile ecosystems: sustainable mountain development	<ul style="list-style-type: none"> • Population change in mountain areas 	<ul style="list-style-type: none"> • Sustainable use of natural resources in mountain areas • Welfare of mountain populations 	

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
Chapter 14: Promoting sustainable agriculture and rural development	<ul style="list-style-type: none"> • Use of agricultural pesticides • Use of fertilizers • Irrigation percent of arable land • Energy use in agriculture 	<ul style="list-style-type: none"> • Arable land per capita • Area affected by salinization and waterlogging 	<ul style="list-style-type: none"> • Agricultural education
Chapter 11: Combating deforestation	<ul style="list-style-type: none"> • Wood harvesting intensity 	<ul style="list-style-type: none"> • Forest area change 	<ul style="list-style-type: none"> • Managed forest area ratio • Protected forest area as a percent of total forest area
Chapter 15: Conservation of biological diversity		<ul style="list-style-type: none"> • Threatened species as a percent of total native species 	<ul style="list-style-type: none"> • Protected area as a percent of total area
Chapter 16: Environmentally sound management of biotechnology			<ul style="list-style-type: none"> • R & D expenditure for biotechnology • Existence of national biosafety regulations or guidelines
Chapter 9: Protection of the atmosphere	<ul style="list-style-type: none"> • Emissions of greenhouse gases • Emissions of sulphur oxides • Emissions of nitrogen oxides • Consumption of ozone depleting substances 	<ul style="list-style-type: none"> • Ambient concentrations of pollutants in urban areas 	<ul style="list-style-type: none"> • Expenditure on air pollution abatement
Chapter 21: Environmentally sound management of solid wastes and sewage-related issues	<ul style="list-style-type: none"> • Generation of industrial and municipal solid waste • Household waste disposed per capita 		<ul style="list-style-type: none"> • Expenditure on waste management • Waste recycling and reuse • Municipal waste disposal
Chapter 19: Environmentally sound management of toxic chemicals		<ul style="list-style-type: none"> • Chemically induced acute poisonings 	<ul style="list-style-type: none"> • Number of chemicals banned or severely restricted
Chapter 20: Environmentally sound management of hazardous wastes	<ul style="list-style-type: none"> • Generation of hazardous wastes • Imports and exports of hazardous wastes 	<ul style="list-style-type: none"> • Area of land contaminated by hazardous wastes 	<ul style="list-style-type: none"> • Expenditure on hazardous waste treatment

CHAPTERS OF AGENDA 21	DRIVING FORCE INDICATORS	STATE INDICATORS	RESPONSE INDICATORS
Chapter 22: Safe and environmentally sound management of radioactive wastes	<ul style="list-style-type: none"> • Generation of radioactive wastes 		

Source: United Nations (30)

3.2 SOCIAL INDICATORS OF DEVELOPMENT

Social indicators of development have been compiled by the World Bank (1996) to assess reductions in poverty. These include indicators of priorities, supplementary indicators (including of access to basic services and social safety nets) and indicators of human resources, natural resources, socioeconomic expenditure and investment in human capital. In combination, they allow monitoring of social conditions at the country level and provide a framework for assessing human welfare.

Table 4
SOCIAL INDICATORS OF DEVELOPMENT

Priority Poverty Indicators	<ul style="list-style-type: none"> • Poverty • Social 	<ul style="list-style-type: none"> • Upper poverty line Headcount index • Lower poverty line Headcount index • GNP per capita • Public expenditure on basic social services • Gross enrollment ratios • Primary <ul style="list-style-type: none"> Male Female • Mortality <ul style="list-style-type: none"> Infant mortality Under 5 mortality • Immunization <ul style="list-style-type: none"> Measles DPT • Child malnutrition (under 5) • Life expectancy <ul style="list-style-type: none"> Total female advantage • Total fertility rate • Maternal mortality rate
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Supplementary Poverty Indicators	<ul style="list-style-type: none">• Expenditure on social security• Social security coverage• Access to safe water<ul style="list-style-type: none">TotalUrbanRural• Access to health care
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Source: World Bank (31)

3.3 HOUSING AND URBAN INDICATORS

Other work on indicators which is relevant to health includes that of the United Nations Centre for Human Settlements (32) with regard to housing and urban areas, which constitutes a monitoring package for cities and the shelter sector. The key indicators were collected by countries in preparation for Habitat II (13) (see Section 1.3). Governments were urged to obtain information for at least the key indicators in one or more cities. The indicators cover socioeconomic development, infrastructure, transport, environmental management, local government, housing affordability, availability and provision, and general background information. Data have been collected for cities all over the world.

UNCHS (33) has also gathered data on specific issues of concern with regard to the quality of housing, such as overcrowding, and the indicators consequently developed have been classified according to whether they are associated with the causes of the problem, the health outcomes or responses to the situation.

3.4 HEALTH INDICATORS

WHO headquarters and regional offices have developed indicators and targets in order to assess the Health for All (HFA) policy, to guide Member States in evaluating their national strategies for HFA and to follow up implementation of the Global Strategy. The HFA indicators have dealt with trends in policy development, socioeconomic development, health and the environment, health resources, health systems, health services and health status. The framework was based mainly on health services, health status, health determinants and health resources. Various regions and individual countries have also been involved in developing HFA indicators (34). A new set of targets, incorporating indicators, has been developed with respect to the renewed HFA policy (1) (see Chapter 6). Indicators which describe the overall health status of WHO Member States (for example as reported in WHO's Annual World Health Report) are also in use (35).

Table 5
INDICATORS OF HOUSING AND URBAN CONDITIONS

A. Background data	
<ul style="list-style-type: none"> • Land use • City population • Population growth rate • Woman headed households 	<ul style="list-style-type: none"> • Average household size • Household formation rate • Income distribution • City product per person • Tenure type
B. Urban Indicators	C. Housing Indicators
<p>Socioeconomic Development</p> <ul style="list-style-type: none"> • Households below poverty line • Informal employment • Hospital beds • Child mortality • School class rooms • Crime rates <p>Infrastructure</p> <ul style="list-style-type: none"> • Household connection levels • Access to potable water • Consumption of water • Median price of water, scarce season <p>Transport</p> <ul style="list-style-type: none"> • Modal split • Travel time • Expenditure on road infrastructure • Automobile ownership <p>Environmental Management</p> <ul style="list-style-type: none"> • Percentage of wastewater treated • Solid waste generated • Disposal methods for solid waste • Regular solid-waste collection • Housing destroyed <p>Local Government</p> <ul style="list-style-type: none"> • Major sources of income • Per-capita capital expenditure • Debt service charge • Local government employees • Wages in the budget • Contracted recurrent expenditure ratio • Government level providing services • Control by higher levels of government 	<p>Housing Affordability and Availability</p> <ul style="list-style-type: none"> • House price to income ratio • House rent to income ratio • Floor area per person • Permanent structures • Housing in compliance <p>Housing Provision</p> <ul style="list-style-type: none"> • Land development multiplier • Infrastructure expenditure • Mortgage to credit ratio • Housing production • Housing investment

Source: United Nations Centre for Human Settlements (32)

WHO has also developed programme indicators to monitor the health of infants and young children, women's health and the health of the general population. The indicators have been classified according to whether they are outcome-related (concerned with health status or death) or process-related (concerned with health care delivery and management) or whether they are determinants (for example behavioural or environmental factors that influence health outcomes). The indicators are intended for use by public health administrators and health programme and service managers (36).

Table 6
SELECTED INDICATORS FOR THE THIRD EVALUATION
OF "HEALTH-FOR-ALL"
(MORBIDITY- AND MORTALITY- RELATED)

- Total fertility rate
- Crude birth rate
- Crude death rate
- % of newborns weighing at least 2500g at birth
- % of children whose weight-for-age and/or height-for-age are acceptable by international standards
- Life expectancy at birth
- Infant mortality rate
- Probability of dying before 5th birthday
- Maternal mortality rate
- Mortality from acute respiratory infections in children under 5
- Mortality from diarrhoeal diseases in children under 5
- Mortality from malaria
- Mortality from measles
- Mortality from tuberculosis
- Life expectancy at age 65
- Mortality from cardiovascular diseases (all types)
- Mortality from cancer (all types)
- Mortality from traffic accidents
- Mortality from work accidents
- Prevalence of guinea worm (dracunculiasis)
- Prevalence of leprosy
- Incidence of malaria
- Incidence of measles
- Incidence of neonatal tetanus
- Number of new cases of polio
- Incidence of tuberculosis
- Prevalence of iodine deficiency disorders in school children
- Prevalence of anaemia in pregnant women
- Prevalence of anaemia in children under 5

(cont'd)

- Prevalence of vitamin A deficiency disorders
- DFMT at age 12 years (mean value)

Source: WHO (37)

Table 7

GLOBAL HEALTH INDICATORS (WHO)

Basic Indicators for all Member States

Population

- Total population (000)
- Annual growth rate (%)
- Dependency ratio (per 100)
- Percentage of population aged 60+ years
- Total fertility rate

Probability of Dying (per 1000)

- Under age 5 (m/f)
- Between ages 15 and 59 years (m/f)
- Life expectancy at birth (years m/f)

Deaths by Cause, Sex, and Mortality Stratum in WHO Region

Cause (total deaths, and % total, burden of disease in disability-adjusted life-years (DALYS)

Communicable diseases, maternal and perinatal conditions and nutritional deficiencies

- infectious and parasitic diseases
- respiratory infections
- maternal conditions
- perinatal conditions
- nutritional deficiencies

Non-communicable conditions

- malignant neoplasms
- other neoplasms
- diabetes mellitus
- nutritional/endocrine disorders
- neuropsychiatric disorders
- sense organ disorders
- cardiovascular diseases
- respiratory diseases
- digestive diseases
- diseases of the genitourinary system
- skin diseases
- musculoskeletal diseases
- congenital abnormalities

Injuries

- unintentional
- intentional

Source: WHO (35)

Table 8

HEALTH AND HEALTH-RELATED INDICATORS IN THE AMERICAS

Demographic Indicators

- Total population (1000s)
- Crude birth rate (1,000 pop)
- Average annual births (1000s)
- Crude mortality rate (1,000 pop)
- Average annual deaths (1000s)
- Annual rate population growth (%)
- Total fertility rate (by women)
- Urban population %
- Dependency ratio (100 pop)
- Life expectancy at birth (years)

Socioeconomic Indicators

- Literate population proportion (%)
- Per capita/day availability of calories
- Population with drinking water supply services (%)
- Population with sewerage and excreta disposal services (%)
- Gross national product (US\$ per capita)
- Annual GDP growth rate (%)
- Population in poverty (%)
- Highest 20%, lowest 20% income ratio

Mortality Indicators

- mortality rate
 - infant (1,000 l.b)
 - under 5 (1,000 l.b)
- under 5 years of age registered deaths
 - Proportion due to: acute diarrhoeal diseases
 - acute respiratory infections
- Maternal mortality rate (100,000 l.b)
- No of registered deaths
 - from: homicide
 - suicide
 - motor vehicle injuries
- Mortality under registration (%)
- Ill-defined deaths (%)
- Mortality rates (m/f) from communicable diseases (100, 000 pop).
- Mortality rates (m/f) from malignant neoplasms (100, 000 pop).
- Mortality rates (m/f) from diseases of the circulatory system (100, 000 pop).
- Mortality rates (m/f) from external causes (100,000 pop)
- Registered deaths from measles
- Reported cases of measles

(cont'd)

- BF+ tuberculosis rate (100,000 pop)
- Reported cases of cholera
- Malaria risk areas (population %)
- Malaria API (1000 pop)
- Reported cases of malaria
- Reported cases of dengue
- AIDS annual incidence rate (1,000, 000 pop)
- M/F ratio of AIDS annual incidence rate (1,000, 000 pop.)
- M/F ratio of AIDS cases
- Newborns with low birth weight (< 2500 g) (%)

Indicators of Resources, Access and Coverage

- Physicians per 10,000 pop
- Nursing professionals per 10,000 pop.
- Dentists per 10,000 pop
- Hospital beds per 1000 pop
- National health expenditure per capita (US\$)
- National health expenditure as % GDP
- Health care by trained personnel (%)
- Under 1 year old vaccination coverage
- Contraceptive use (women all methods) (%)

Source: PAHO/WHO (38)

Table 9

WHO PROGRAMME INDICATORS

Indicators for Monitoring the Health of Infants and Young Children

- Under-five deaths due to acute respiratory infections
- Treatment of pneumonia cases
- Maternal knowledge of when to seek care for ARI
- ARI case management capability of health facilities
- Care-seeking for children with acute respiratory infections
- Exclusive breast feeding
- Annual incidence of diarrhoea in children under 5 years of age
- Increased fluid intake and continued feeding during diarrhoea episodes
- Deaths due to diarrhoea among infants and children under 5 years of age
- Mothers' knowledge of home therapy for diarrhoea
- Polio incidence- Immunization coverage
- Neonatal tetanus incidence
- Tetanus immunization coverage for women of child-bearing age
- Measles cases
- Measles case fatality
- Measles deaths
- Goitre prevalence rate

(cont'd)

- Infant mortality rate
- Under five mortality rate
- Stunting prevalence
- Underweight prevalence
- Wasting prevalence
- Prevalence of night blindness in pre-school children

Indicators for Monitoring the Health of Women

- HIV prevalence in pregnant women
- Maternal mortality ratio
- Prenatal care coverage
- Anaemia in women
- Case fatality rate of direct obstetric complications
- Births attended by trained health personnel
- Availability of essential obstetric care
- Current of contraception by women
- Sexually transmitted diseases prevalence in women
- Screening for cancer of cervix

Indicators for Monitoring the Health of the General Population

- Disability rates
- Monthly incidence of Guinea-worm cases
- Annual incidence of Guinea-worm cases
- Villages with new cases of Guinea-worm
- Access to safe drinking water
- Access to sanitary means and excreta disposal
- Availability of essential drugs
- Quality of drugs
- Iodization of salt
- Condom availability
- Knowledge of HIV-related preventive practices
- Condom use with non-regular sex partners
- Incidence rate of severe malaria
- Availability of anti-malaria drugs in health facilities
- Reported sexually transmitted diseases incidence in men
- STD case management
- Annual tuberculosis case notification
- Tuberculosis treatment case notification
- Tuberculosis treatment completion rate
- Tuberculosis fatality rate
- Incidence rate of acute myocardial infarction
- Prevalence of hypertension
- Incidence of stroke
- Incidence of rheumatic fever
- Prevalence of smoking

Source: WHO (36)

Indicators for specific WHO programmes have also been developed, such as those for assessing vitamin A deficiency (39), for monitoring national drug policies (40), and for evaluating programmes to ensure food safety. WHO, for example, previously published a set of guiding principles, which apply to the preparation of country profiles and databases, concepts and processes associated with evaluation and indicators for evaluating programmes to ensure food safety and various aspects of food safety evaluation (41).

Much work has also been done by WHO on indicators in environmental health (42). The publication *Linkage Methods for Environment and Health Analysis* (22) addresses methods of linking information on health and the environment and use of indicators for quantifying and monitoring environmental health. Field studies have been carried out to obtain information on aspects of environmental health status and particular environmental health problems (42). Environmental health indicators have been developed by WHO Regional Offices, for example the Regional Office for Europe (EURO), the Regional Office for South-East Asia (SEARO) and the Regional Office for the Eastern Mediterranean (EMRO).

Table 10

SELECTED ENVIRONMENTAL HEALTH INDICATORS

ISSUE	THEME/ TOPIC	INDICATOR	EXAMPLE DEFINITION
Socio-demographic context	Poverty	Poverty	Human poverty index (compound index)
	Population density	Population density	Population density
	Population growth	Rate of population growth	Annual net rate of population growth
	Age structure	Dependent population	Percentage of people aged less than 16 years or 65 years or more
	Urbanisation	Rate of urbanization	Annual net rate of change in the proportion of people living in urban areas
	Infant mortality	Infant mortality rate	Annual death rate of infants under 1 year of age
	Life expectancy	Life expectancy	Number of years a newborn baby is expected to live, given the prevailing mortality rate
Air pollution	Outdoor air pollution	Ambient concentrations of air pollutants in urban areas	Mean annual concentrations of ozone, CO, particulates (PM10, PM2.5, SPM), SO ₂ , NO ₂ , O ₃ and lead in the outdoor air in urban areas

ISSUE	THEME/ TOPIC	INDICATOR	EXAMPLE DEFINITION
Air pollution	Indoor air pollution	Sources of indoor air pollution	Percentage of households using coal, wood or kerosene as the main source of heating and cooking fuel
	Respiratory illness	Childhood morbidity due to acute respiratory illness	Incidence of morbidity due to acute respiratory infections in children under 5 years of age
	Respiratory illness	Childhood mortality due to acute respiratory illness	Annual mortality rate due to acute respiratory infections in children under 5 years of age
	Air quality management	Capability for air quality management	Capability to implement air quality management
	Air quality management	Availability of lead-free gasoline	Consumption of lead-free gasoline as a percentage of total gasoline consumption
Sanitation	Excreta disposal	Access to basic sanitation	Proportion of the population with access to adequate excreta disposal facilities
	Diarrhoea	Diarrhoea morbidity in children	Incidence of diarrhoea morbidity in children under 5 years of age
	Diarrhoea	Diarrhoea mortality in children	Diarrhoea mortality rate in children under 5 years of age
Shelter	Informal settlements	Percentage of population living in informal settlements	Percentage of the population living in informal settlements
	Unsafe housing	Percentage of population living in unsafe housing	Percentage of the population living in unsafe, unhealthy or hazardous housing
	Home accidents	Accidents in the home	Incidence of accidents in the home
	Urban planning	Urban planning and building regulations	Scope and extent of building and planning regulations for housing
Access to safe drinking water	Water quality/supply	Access to safe and reliable supplies of drinking water	Percentage of the population with access to an adequate amount of safe drinking water in the dwelling or within a convenient distance from the dwelling

ISSUE	THEME/ TOPIC	INDICATOR	EXAMPLE DEFINITION
Access to safe drinking water	Water quality/ supply	Connections to piped water supply	Percentage of households receiving piped water to the home
	Diarrhoea	Diarrhoea morbidity in children	Incidence of diarrhoea morbidity in children under 5 years of age
	Diarrhoea	Diarrhoea mortality in children	Diarrhoea mortality rate in children under 5 years of age
	Water-borne diseases	Outbreaks of water-borne diseases	Incidence of outbreaks of water-borne diseases
	Water quality monitoring	Intensity of water quality monitoring	Density of water quality monitoring network
Vector-borne disease	Population at risk	Population at risk from vector-borne diseases	Number of people living in areas infected by disease vectors
	Vector-borne disease mortality	Mortality due to vector-borne diseases	Mortality rate due to vector-borne diseases
	Vector control	Adequacy of vector control and management systems	Percentage of the at-risk population covered by effective vector control and management systems, by disease type
Solid waste management	Waste collection	Municipal waste collection	Percentage of population served by regular waste collection services
	Waste disposal	Municipal waste disposal	Mass of solid waste disposed of by municipal waste management services
	Waste management	Hazardous waste policies	Effectiveness of hazardous waste policies and regulations
Hazardous/ Toxic substances	Blood lead	Blood-lead level in children	Percentage of children with blood lead levels >10 ug/dl
	Chemical poisonings	Mortality due to poisoning	Mortality rate due to poisoning
	Contaminated land	Contaminated land management	Scope and rigour of contaminated land management
Food safety	Food-borne diseases	Food-borne illness	Outbreak rate of food-borne illness
	Diarrhoea	Diarrhoea morbidity in children	Incidence of diarrhoea morbidity in children under 5 years of age

ISSUE	THEME/ TOPIC	INDICATOR	EXAMPLE DEFINITION
Food safety	Diarrhoea	Diarrhoea mortality in children	Diarrhoea mortality rate in children under 5 years of age
	Monitoring of food safety	Monitoring of chemical hazards in food	Proportion of potentially hazardous chemicals monitored in food
Radiation	Radiation exposure	Cumulative radiation dose	Percentage of the population receiving an effective radiation dose in excess of 5 mS/yr
	UV exposure	UV light index	UV light index
Non-occupational health risks	Motor vehicle accidents	Mortality from motor vehicle accidents	Death rate due to road accidents
	Non-occupational injury	Injuries to children	Incidence of physical injury to children less than 5 years of age
	Poisoning	Incidence of poisonings of young children	Number of reported poisonings per year in children under 5 years of age
Occupational health risks	Occupational hazards	Exposure to unsafe workplaces	Percentage of workers exposed to unsafe, unhealthy or hazardous working conditions
	Occupational morbidity	Morbidity due to occupational health hazards	Incidence of occupational injury
	Occupational mortality	Mortality from occupational health hazards	Incidence of occupational mortality

Source: Briggs (43)

Some baseline indicators developed by the WHO European Healthy Cities project relate to health, demography, health services, the environment and socioeconomic status. This first systematic effort to collect and analyze a wide array of data from cities across Europe (44) has provided important insights into the way in which indicators are understood in different countries, as well as relevant information on the availability, reliability and validity of data. The indicators were formally adopted by participating cities in 1990, and information on the 53 agreed indicators was collected from cities between 1992 and 1994.

Table 11
INDICATORS OF HEALTHY CITIES (EUROPEAN REGION)

Health Indicators

- Mortality: all causes
- Cause of death
- Low birth weight

Health Service Indicators

- Existence within city of inventory of self-help organizations
- Existence within the city of a support programme for self-help organizations
- Existence of a city health education programme
- Percentage of six-year old children fully immunized (having received all compulsory vaccinations)
- Number of inhabitants per practising general practitioner
- Number of inhabitants per nurse
- Percentage of population covered by health insurance
- Percentage of population having access to an emergency medical service which is less than 30 minutes away by car
- Availability of primary health care services in foreign languages
- Health information communication
- Number of health questions examined by the city council every year

Environmental Indicators

- Atmospheric pollution
- Microbiological quality of the water supply
- Chemical quality of the water supply
- Percentage of water pollutants removed from total sewage produced
- Household waste collection quality index
- Household waste treatment quality index
- Pollution level indicator as perceived by the population
- Quantity of drinking-water used per inhabitant per day
- Relative surface area of green spaces in the city
- Public access to green spaces
- Derelict industrial sites
- Sport and leisure
- Pedestrian streets
- Cycling in city
- Public transport
- Public transport network cover
- Living space
- Comfort and hygiene
- Emergency services

(cont'd)

Socioeconomic Indicators

- Number of square metres of living space per inhabitant
- Percentage of population living in substandard dwellings
- Estimated number of homeless people
- Unemployment rate
- Work absenteeism rate
- Percentage of families below the national poverty level
- Percentage of total employment provided by the 10 most important economic activities
- Percentage of one-person households
- Percentage of single-parent families
- Percentage of children leaving school after compulsory education
- Illiteracy rate
- Percentage of city's budget allocated to health and social actions
- Crime rate
- Percentage of dwellings for elderly people who have emergency call facilities
- Main causes for emergency calls
- Percentage of young children on waiting lists for child-care facilities
- Median age of women giving birth for the first time
- Abortion rate in relation to total number of births
- Percentage of people under 18 "under police surveillance"
- Percentage of disabled people in employment compared to total number of disabled people of working age (between 18 and 65).

Source: WHO (44)

3.5 COMMON COUNTRY ASSESSMENT INDICATORS

The common country assessment (CCA) indicator framework, developed by the United Nations Development Group (UNDG) as an indicator framework following United Nations conferences and summits, is being used by United Nations funds and programmes in over 100 countries. The United Nations Statistics Division, together with UNDG will be analyzing the lessons learned from the CCA indicator experiences. The CCA indicator framework, anticipating changes in the environmental indicators, includes provision for further review of environmental indicators, in order to maintain concordance between the two indicator sets.

Both the United Nations Statistics Division and UNDG are working with a number of selected countries to assess: a) to what extent the national statistical system is involved in the CCA indicator effort and what the impacts are of the CCA indicator requirements on the national statistical system; b) which indicators are being used; c) what the data gaps are; d) how the United Nations Development Assistance Framework (UNDAF)-CCA indicator process is related to other policy processes (for example

IMF/World Bank Poverty Reduction Strategies for countries qualifying for enhanced debt relief; and e) what targeted programmes are being proposed to address the lack of data or data quality (45). (See Appendix 1 for Union of Selected Core Indicator Sets).

4

CONSTRUCTION OF INDICATORS

In this chapter, criteria for the development and use of indicators are outlined, and issues to be addressed in their construction are highlighted. The applicability of the criteria developed will depend on the indicators in question and on the purpose of the indicator. Issues discussed include the specification of indicators, measurement units and variables, assessment of data sources, statistical considerations and issues of interpretation and risk communication. Examples are given to illustrate these aspects.

4.1 CRITERIA FOR INDICATORS

“Indicators are a way of seeing the big picture by looking at a small piece of it” (46).

Plan Canada (46) has described the process of indicator development as involving the following elements:

- definition of the characteristics to be measured
- identification of the target audience and the purpose of the indicator
- choosing a framework (i.e. one based on goals, issues, sectors or stress-condition-response)
- definition of criteria for selecting indicators
- identification and evaluation of a potential indicator on the basis of the selection criteria
- pilot-testing of the indicator
- choosing the final set and reviewing the indicator periodically.

Different types of decisions and issues require different types and levels of indicators. To be really useful, indicators should be applicable to the user and not just technically relevant or relevant to the data providers. The choice of indicators will depend on such factors as the purpose for their use and the target audience. As stated earlier, indicators can be used for problem definition, policy formulation, policy implementation and evaluation. Sometimes the same indicators can serve many purposes, while in other situations separate sets of indicators may be needed.

Many organizations have attempted to define criteria for the construction and selection of indicators, depending on whether they apply to policy, analytical soundness or measurability. They may also be assessed in relation to factors such as transparency, scientific validity, robustness, sensitivity and the extent to which they are linkable, or

according to whether they are relevant to the issue they are intended to describe, whether they relate to changes in policy and practice or whether they “strike a chord” with their intended audience (21).

Criteria that could be used in developing indicators are given in the box below. The applicability of the criteria depends, however, on the particular indicator and on the purpose for which it is to be used. For example, if the main concern is long-term environmental change, the criteria will include such factors as responsiveness to changes in the environment and human activities, capacity to provide early warning of pending changes, sensitivity to changes in the environment and so forth. If the indicators are intended primarily to inform the general public, the criteria will include such factors as simplicity, ease of interpretation and attractiveness to a range of interested parties. No single set of criteria will be applicable to all the indicators derived. Indeed, if all the indicators selected were to conform with all the desired criteria, very few would exist. Each situation has its own priorities for data collection and analysis.

As stated earlier, indicators of health and environment are based on the concept of a link between a factor in the environment and a health outcome (22). An environmental or a health outcome indicator can thus be regarded as an indicator of a health-environment relationship if there is some connection between the health indicator and the environment or between the environmental indicator and health. This is not as simple as it sounds because of the complexity of the factors involved, which bear on the nature of the relationship between the environment and human health (these are discussed more fully in Chapter 7). Nevertheless, even if direct evidence of the nature of the relationship cannot be obtained or it cannot be quantified, indirect information on interactions between the environment and health can often be obtained, and reasonable inferences can be made on the basis of general knowledge about the relationship.

Indicators must be as specific as possible with respect to a particular issue, in order to maximize the usefulness of the information for decision-making. Indicators should also be scientifically credible, unbiased and representative of the condition concerned. The aspect of representativeness is particularly important when descriptive indicators are used to obtain baseline information on health and environment in a particular setting (see Section 2.2). Indicators should be consistent and comparable in different settings, in both time and space, and should be relatively unaffected by small differences in methods and measurement techniques that may occur in the various contexts and settings in which information is collected.

In order to be as useful as possible, indicators should be readily understandable by interested parties and potential users and should be based on information that is either readily available or relatively easy and inexpensive to collect. The data should also allow disaggregation in order to assess trends at the lowest possible level of resolution, to identify groups or areas at risk and to allow identification of inequities (on the basis of geographical patterns, sex, socioeconomic status and other variables).

The general criteria for health and environment indicators listed in the box below are meant to serve as an overall guide to the types of issues that should be considered.

Box 4

GENERAL CRITERIA FOR INDICATORS

Indicators should be:

Generally relevant

- Related to a specific question or issue of concern
- Health-related and linked to environment/development factors
- Sensitive to changes in the conditions in question
- Give early warning of pending changes

Scientifically sound

- Unbiased and representative of the conditions in question
- Scientifically credible, reliable and valid
- Based on the best available data of acceptable quality
- Robust and unaffected by minor changes in the method or scale used in their construction
- Consistent and comparable over time and space

Applicable to users

- Relevant to policy and management needs
- Based on data that are available or can be collected or monitored with a reasonable financial/time resource input
- Easily understood and applied by potential users
- Acceptable to stakeholders

Source: modified and adapted from Briggs *et al.* (22)

In addition to these general criteria, others for the development of international and local indicators may be specified (see also Sections 2.3 and 2.4).

Box 5

CRITERIA FOR INDICATORS OF USE FOR INTERNATIONAL PURPOSES

These indicators should be:

- Linked to broadly identified common problems and global priorities
- Appropriate for inter-country comparisons
- Relevant to international initiatives such as Health for All and Agenda 21 or to international conventions and treaties
- Attractive to a range of sectors, partners and institutions
- Ideally usable for decision-making at different tiers of government
- Based on sound, internationally comparable data that are readily available or easily and relatively inexpensively collected

Box 6

CRITERIA FOR INDICATORS OF USE FOR LOCAL PURPOSES

These indicators should:

- Be relevant both to individual citizens and to local government
- Reflect local circumstances
- Be based on information that can be readily collected
- Show trends over a reasonable period of time
- Be meaningful both in their own right and in conjunction with other indicators
- Be clear and easy to understand, in order to educate and inform
- Provoke change (for example in policies, services or lifestyles)
- Lead to the setting of targets or thresholds

Source: adapted from Local Government Management Board, United Kingdom (47)

While there are no cardinal rules or set procedures to be followed in developing indicators, the issues discussed in the following sections might serve as a useful guide.

4.2 DEFINITION AND SPECIFICATION OF INDICATORS, MEASUREMENT UNITS AND VARIABLES

In identifying the type of data that will be needed for a particular indicator, the indicator must be clearly defined and the measurement units and variables specified. Indicators may be defined with different levels of specificity, for instance, as “the amount of ozone-depleting substances eliminated as a result of the Montreal Protocol”, “the median usable living space per person”, “the percentage of the population living in urban areas”, “emissions of sulfur dioxide into the atmosphere” or “the percentage of people who feel safe going out at night”. Some indicators have precise definitions, others have definitions involving choices, while yet others have only loose definitions and may be less quantifiable and measurable.

The units of measurement must be clearly defined, for example:

- Tons of sulfur dioxide emitted per year
- Annual environmental health expenditure in US\$
- Tonnes of fertilizer nutrients per 10 km² of agricultural land
- Biological oxygen demand expressed as milligrams per litre of oxygen consumed in 5 days at a constant temperature of 20° C
- Litres of water consumed per capita per day
- Proportion of people living in areas with air quality within acceptable standards
- Number of square metres of living space per inhabitant.

A number of factors should be considered in defining the actual measurement variables in respect of the indicator definition used. These are illustrated in the example below.

Table 12
DEFINING INDICATORS

Name of indicator	Definition
<ul style="list-style-type: none"> Existence of a city health education programme 	Health education programmes are made up of one or several projects which aim to improve knowledge, assistance and services to individuals for developing and maintaining a healthy way of life
<ul style="list-style-type: none"> Living space 	Average number of rooms per inhabitant. The rooms are counted if they have a distinct purpose or if they are >4m ² for example kitchen, dining room, bedrooms, etc. Bathrooms, laundry rooms, hallways, etc. are not counted as rooms
<ul style="list-style-type: none"> Low birthweight 	Percentage of children weighing 2.5 kg or less at birth
<ul style="list-style-type: none"> Percentage of single parent families 	A family: part of household comprising at least two people: either a couple, married or not and any unmarried children (= single parent family) NB: children aged less than 18 years

Source: WHO (44)

THE EXAMPLE OF LEAD: DEFINING MEASUREMENT VARIABLES

If an indicator is defined as “the annual rate of change in the urban population unduly exposed to lead in the environment”, the terms “population unduly exposed to lead in the environment” must be defined. In countries where leaded gasoline is still used, the population could include people living near major roads, people living in the vicinity of lead-emitting industries, people living in old housing with lead-based paint, people living in homes with lead water pipes and so forth.

In turn, it would be necessary to define terms such as “old housing” (homes built before a certain year), “lead-based paint” (paint with more than a certain percentage of lead in the acid-leachable fraction), “major roads” (roads with more than a certain amount of vehicle traffic per hour or per day) and “lead-emitting industry” (taking into account the need to distinguish between exposure to heavily polluting industries and to industries that emit relatively little lead).

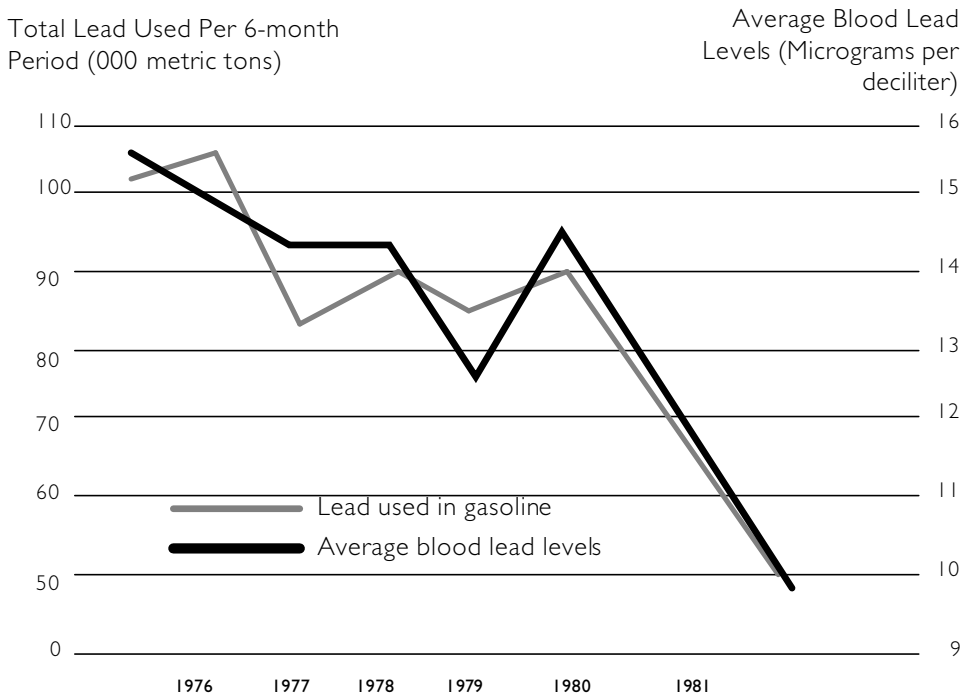
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It would then be necessary to define the proportion of people in these settings who are exposed, for example, to lead in air, dust and water at levels that are above or below a specified concentration. Alternatively, instead of using indirect (proxy) measures of exposure, more direct, biological indicators might be considered, such as blood lead (indicative of short-term exposure), tooth lead (cumulative, life-time exposure), or even hair lead (medium-term exposure). Measures of biological effect, such as zinc protoporphyrin concentration or the activity of the ALA-D (aminolaevulinic acid dehydratase) enzyme, might also be examined, and a cut-off point indicative of "undue" exposure (such as a blood lead concentration above 10 micrograms per deciliter), could be defined for each parameter. This would give an indication of exposure but would not in itself provide an indication of the source of the exposure (see Chapter 7 for further discussion).

The period over which the indicator provides an average could be particularly important in the event of significant variations in exposure by time of day, week, month, season and so forth. This could be especially important if the situation is compared to standards or guidelines based on specific averaging periods.

Figure 3
REDUCING LEAD IN GASOLINE

Decreases in Blood Lead Values and Amounts of Lead Used in Gasoline in the United States, 1976-80



Source: Thomas (48)

4.3 SPECIFICATION OF DATA SOURCES

Once the measurement variables have been defined, the data requirements and sources can be more readily specified. It is important for countries and organizations to note the data requirements implied by indicators and to incorporate these data in their standard monitoring and reporting systems as far as possible. Local circumstances will usually dictate what is feasible in terms of data collection. Monitoring and surveillance programmes may provide the basic data for indicator construction and indeed may be the only information available for the purpose. Nevertheless, the available data may refer to health and environmental conditions at different levels of resolution, making it difficult to form links between health and environmental conditions or to identify groups at risk. Data may be available for inadequate time periods or intervals and may not suffice to determine spatial or temporal trends.

Obtaining relevant data at country level remains a significant problem, particularly in poor countries, where there is often inadequate coverage and problems such as misclassification of illnesses and quality control in measurements may occur. Nevertheless, most countries have some kind of information system, even if it is fairly rudimentary and the recording systems incomplete. Almost all countries experience problems of data coverage and quality, to a greater or lesser degree. When data are not available or not usable, special surveys could be carried out that are restricted to specific issues, areas or groups. In many cases, valuable data can be provided simply by strengthening existing systems. A key priority is to establish information management systems in countries with poorly developed data sources.

All major sources of information relevant to the measurement variables should be identified. This will depend on the level of resolution at which the data are required. For most issues, there is no single source of information for any one indicator, so that many sources may have to be consulted for different pieces of information. It might be necessary to use routine information collected by government departments and agencies (global, national and local) and published in annual reports or censuses, for example. Information may also be obtainable from universities and research organizations, non-governmental organizations and community-based organizations, service organizations, environmental monitoring groups, industry and the private sector. Reports on the state of the environment, audits, monitoring programmes and censuses are useful sources of data at all levels.

A relatively large amount of data is available on health and environmental conditions world-wide, going back over a long period. For example, much useful data has been generated in various global monitoring programmes such as the former UNEP/WHO Global Environmental Monitoring System (GEMS) network (49, 50), and trans-national information systems such as the CORINE system (51). Improvements in field monitoring techniques and advances in modeling and computing have increased the amount of data on the state of the environment at various levels.

The quality and quantity of health information has also improved with advances in health information systems and health reporting. Several international sources of information are available on environmental health effects, such as the Environmental

Health Criteria series produced by WHO, UNEP and ILO, the International Register of Potentially Toxic Chemicals, monographs on the carcinogenicity of chemical substances produced by the International Agency for Research on Cancer (IARC) and various WHO guideline documents such as those on the quality of drinking-water and air.

Table 13
SOURCES OF HEALTH AND ENVIRONMENTAL INFORMATION

Report title	Organization
Global environment outlook	UNEP, Nairobi
Human development report	UNDP, New York
State of the world's children	UNICEF, New York
United Nations statistical yearbook	UN, New York
Vital signs	Worldwatch Institute, Washington
State of the world	Worldwatch Institute, Washington
State of world rural poverty	IFAD, Rome
World development report	World Bank, Washington
World health report	WHO, Geneva
World health statistics annual	WHO, Geneva
World resources report	World Resources Institute, Washington

Source: WHO (7)

4.4 ASSESSMENT OF DATA

Depending on the nature of the available data and the indicator requirements, it may be necessary to reconsider the design of the indicator, for instance by choosing a substitute or a different level of aggregation. This may be the case if the available data are of questionable quality in relation to the use for which the indicator is intended. In some cases, very detailed data might be needed for a particular parameter, whereas

in others a rough indication of a parameter might suffice.

Bearing in mind the repercussions (often financial) for decision-makers of acting on the basis of information conveyed through indicators, it is vital to ensure that the information collected is as accurate and reliable as the situation dictates. Quality control is an important aspect which must be carefully addressed (see further standard texts on epidemiology). For example, the accuracy and reliability of routine health data may differ greatly from one place to another. As already indicated, discrepancies in diagnosis, notification and reporting (under- and over-reporting) may occur, as well as differences in referral procedures and misclassification of diseases. The problem is usually more serious with regard to data on morbidity than to that on mortality, for which standard classifications exist. Quality control of environmental data is also subject to a variety of problems. Differences in sampling and measurement methods may affect the results, and the data may be unrepresentative. For all these reasons, procedures for checking accuracy, consistency and comparability should be introduced.

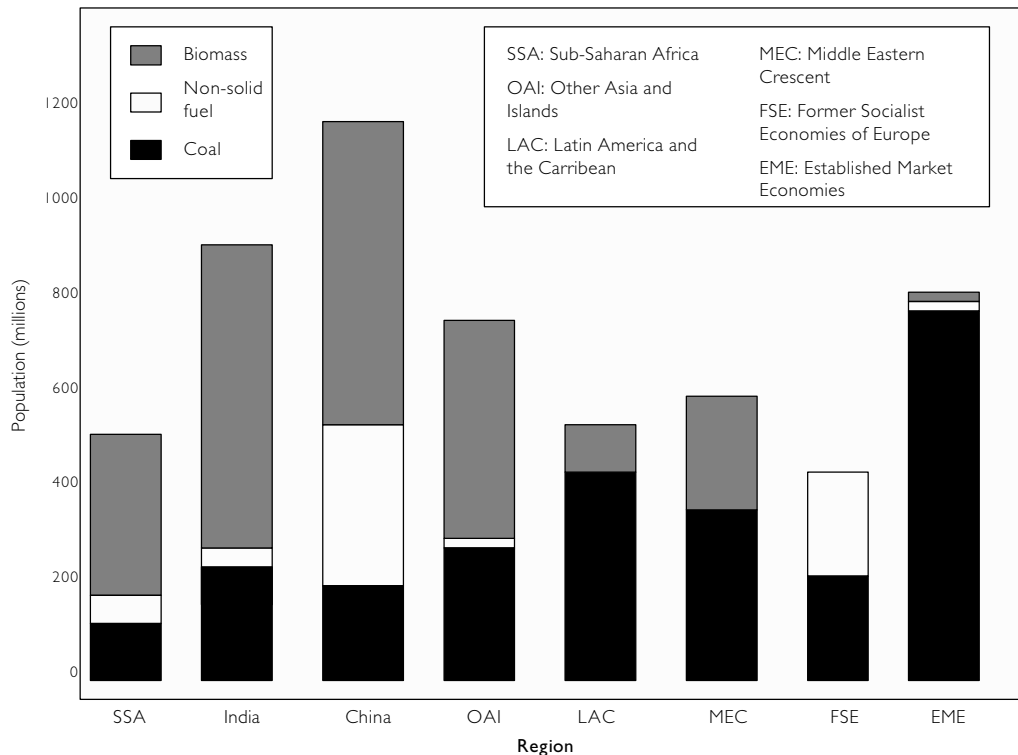
Trends should be examined for inconsistencies, data sources should be assessed, and “outliers”, or unexpected departures from established relationships, should be carefully checked. The definitions used, the data sources relied upon and the methods used should be carefully documented, so that the process of information collection is as transparent as possible, enabling outside parties to cross-check data for their validity (22). For example, if the measurement variable concerned is the concentration of nitrogen dioxide, the methods used for monitoring (passive versus stationary monitoring) and the analytical procedures (spectrophotometry, ion chromatography or others) should be specified. If the measurement variable is blood lead concentration, the blood sampling method (for example intravenous or capillary) and the analytical techniques (for example atomic absorption spectrophotometry or gas chromatography) should be specified. Quality control measures should be specified in all cases.

4.5 STATISTICAL CONSIDERATIONS

The form in which an indicator is presented can have important consequences for decision-making (see also Section 4.6). An indicator can be measured at one time, over several times or continuously, to show changes in a parameter. Indicators can be presented in a variety of statistical forms, for example as simple frequencies or magnitudes (number of deaths, number of people with health effects of interest), as rates (emissions, mortality and morbidity), as ratios (for example pollution level in relation to the WHO guideline level, standardized mortality ratio), as measurements of rate change (rate of population growth, rate of reduction in air pollution level), or in various more complex forms. The form chosen should reflect the purpose of the indicator.

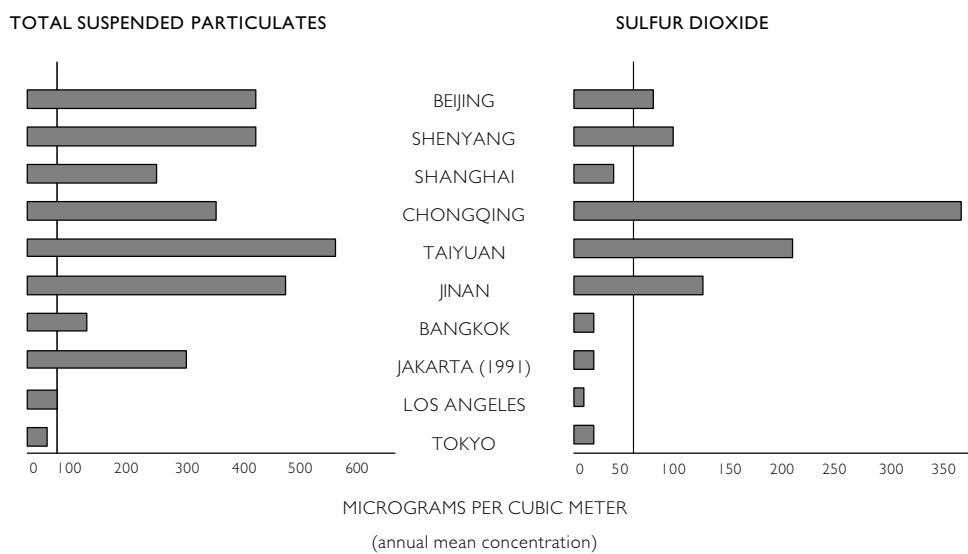
It is usually necessary to identify the level of geographic aggregation and the denominator population, the group or groups at risk and the spatial and temporal dimensions of the problem or issue to be addressed. When relevant and possible,

Figure 4
NUMBERS OF PEOPLE USING DIFFERENT HOUSEHOLD FUELS, BY REGION, 1990s



Source: WHO (7)

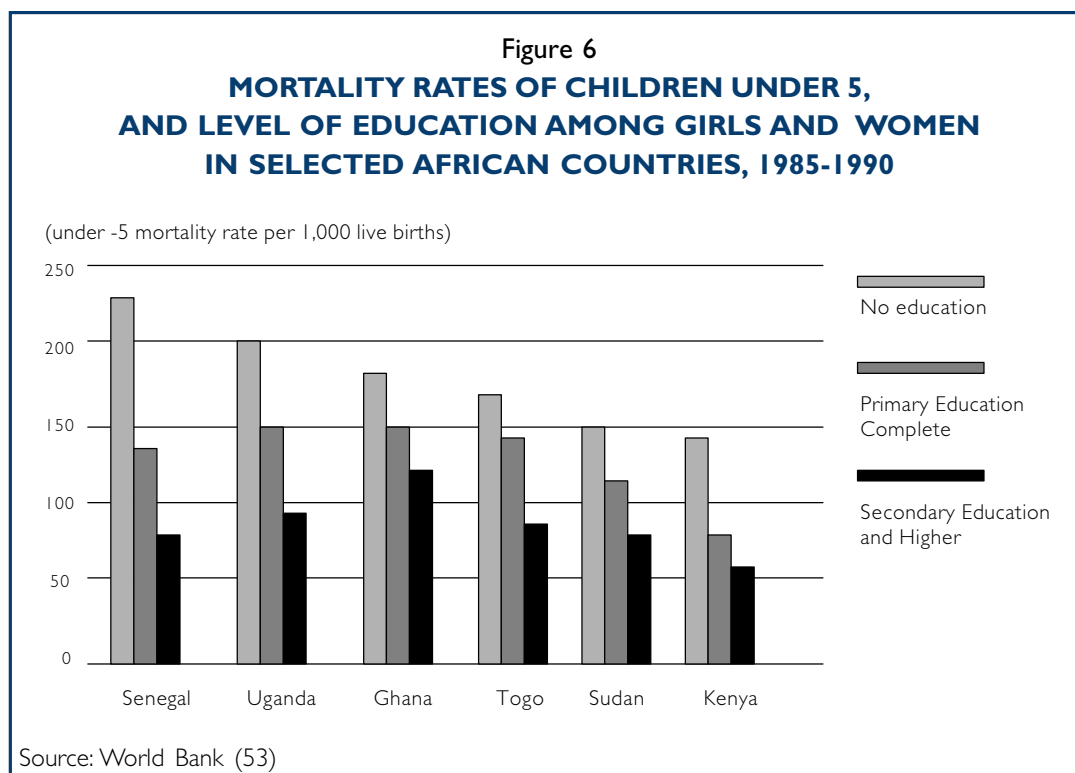
Figure 5
AMBIENT CONCENTRATIONS OF AIR POLLUTANTS, 1995 (CHINA)



Source: World Bank (52)

data should be disaggregated, for example, by age and sex, geographical area, socioeconomic status, urban-rural divide, national and sub-national level and by other indicators of inequity and inequality.

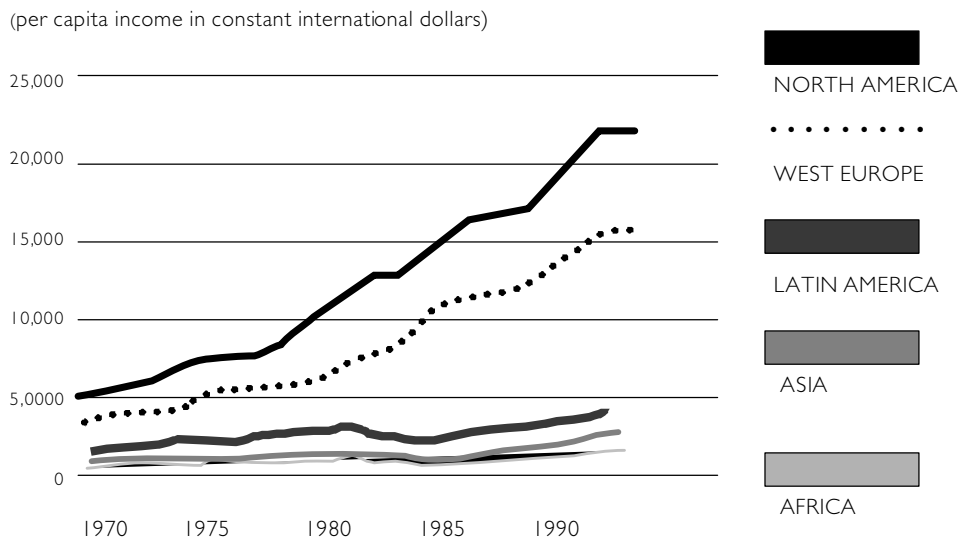
Absolute counts or frequencies are usually not very useful, as they do not take account of the size of the population at risk, which may be large or small, increasing or decreasing and will therefore affect the absolute counts of events such as deaths. The rates calculated should relate the event to the population at risk, for example, representing infant deaths per 1000 population or children with raised blood lead



levels per 1000 population in the target group. Both the prevalence rate (proportion of existing cases of disease at one time in a particular population) and the incidence rate (proportion of new cases of a disease occurring over a specified period in a population) may be used. Age-standardized mortality ratios are useful for comparing populations with different characteristics; for instance, deaths from lung cancer in a residential town with many elderly inhabitants compared with that in an industrial town with a younger, working-class population.

Trends in indicators are useful in determining whether situations are improving, deteriorating or stable. Trends can be discerned from information collected over a period of time, by methods of collection and sampling that remain relatively uniform during that period, in order to avoid introducing bias. A trend can be ascertained by comparison with another rate, which might be the expected background rate or the rate at some earlier time. It is important to specify the baseline or reference data against which the indicator will be standardized, reflecting the statistical form of the indicator and the level of geographic aggregation.

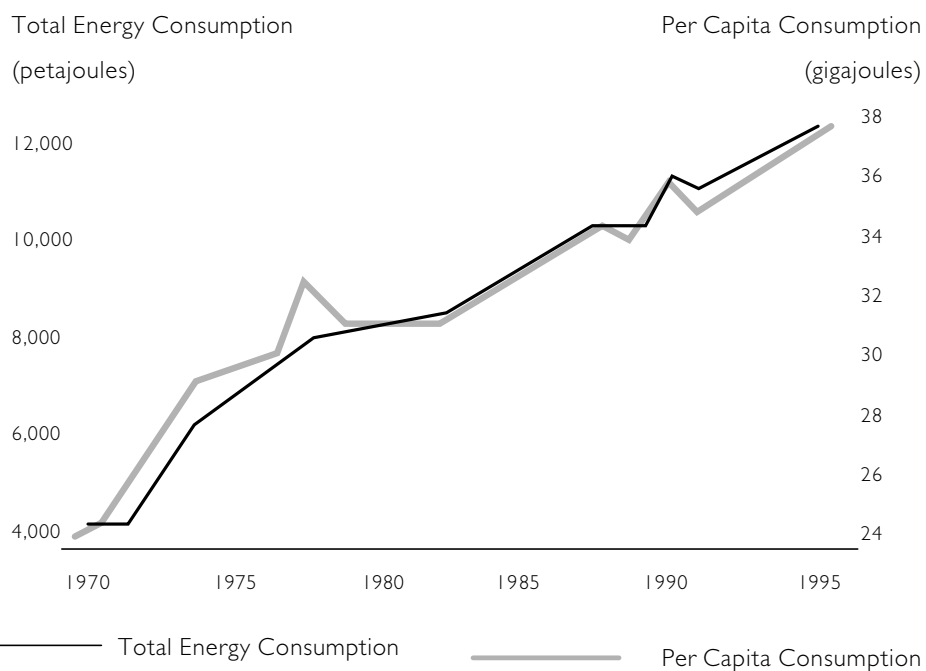
Figure 7
PER CAPITA INCOME BY REGION, 1970-1991



Source: UN (54)

Note: Based on purchasing power parity.

Figure 8
TOTAL AND PER CAPITA ENERGY CONSUMPTION, 1970-1995



Source: adapted from World Resources Institute (2)

Pilot testing is crucial in determining whether an indicator is sensitive to variations in the conditions concerned, whether the computing methods are sufficiently robust and the data adequate and whether the results of the indicator are interpretable. Problems in obtaining, processing and analysing data need to be ascertained in advance. Valuable lessons can be learnt from various programmes for field-testing indicators, such as those carried out by the Local Government Management Board in the United Kingdom (55), by the WHO European Region (Healthy Cities indicators) (44) and the United Nations Sustainable Development Indicator Testing Programme (30).

4.6 INTERPRETATION AND RISK COMMUNICATION

Indicators can be presented in various forms: graphically, as a map, or as a simple statistic. In deciding on the form of presentation to be used, the target audience must be kept in mind, since a form that is suitable for, and understandable to health professionals may not necessarily be appropriate for policy-makers, decision-makers or the general public. Illustrations and diagrams can be useful in making data accessible and can relay much information in a clear, readily comprehensible way.

The form in which information is conveyed can have a considerable impact on how it is used and interpreted. For example, presentation of the infant mortality rate at a particular time (perhaps in relation to other countries or cities) conveys different information from a presentation as a trend over time.

POVERTY IN THE USA

Census tracts defined for metropolitan areas, cover 75% of the total US population. The poverty line is defined as the income level at which the estimated cost of a low-cost food plan for a family of three or more would consume 33% of the family's total income. A high poverty census tract is defined as one in which 40% or more of the population is below the poverty line. The percentage of poor people living in high poverty census tracts is a measure of the concentration of poverty in urban areas. It is widely believed that poor people are worse off living in areas of concentrated poverty than they would be in other areas, and that society as a whole suffers when these areas of concentrated poverty exist. Furthermore, growth in areas of concentrated poverty has negative implications for the future because children reared in very poor neighbourhoods are at risk of poor development outcomes.

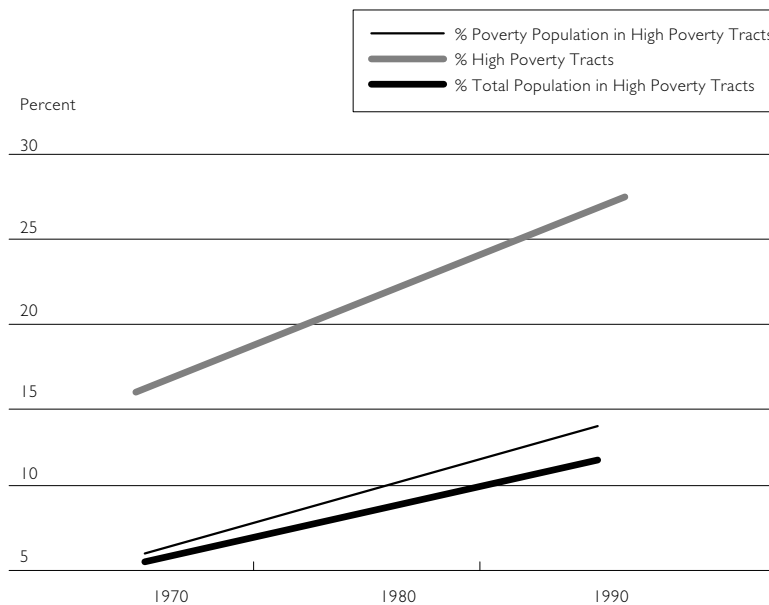
The graph shows three measures of the concentration of poverty in urban areas:

1. The percentage of the population below the poverty line living in high poverty census tracts (from 16.5% in 1970 to 28.2% in 1990);

(cont'd)

2. The percentage of census tracts which are defined as "high poverty" with 40% or more of the population in the tract below the poverty line (from 6% in 1970 to 13.7% in 1990);
3. The percentage of total population living in high poverty census tracts (from 5.2% in 1970 to 10.7% in 1990).

Figure 9
HIGH POVERTY CENSUS TRACTS:
40% OR MORE OF POPULATION BELOW
THE POVERTY LINE, 1970 - 1990



Source: Sustainable Development in the United States (56)

As a general rule, the information obtained should be conveyed to policy-makers, decision-makers and the general public in a form that is useful and informative but does not cause undue anxiety. Factors that are beyond the individual's control or which impart no direct benefit are likely to cause more anxiety than factors over which the individual has direct control and which are associated with a perceived benefit.

In the United Kingdom, the Local Government Management Board initiated a pilot project with various local authorities to develop and use indicators. There was agreement that good presentation was critical to the use of indicators. Good communication demands skills in writing and illustration, particularly in simplifying but not over-simplifying information.

Box 7

KEY ISSUES FOR THE COMPREHENSIBILITY OF INDICATORS

- Balance between sophisticated indices and simpler measurements which are more readily explained and understood
- Non-technical data and graphics more useful for people of a range of backgrounds
- Clear language preferred, avoidance of jargon
- Lengthy documents inaccessible to many people. Short summary with graphics, supported by longer, more technical explanation for policy-makers and their advisers, may be appropriate
- Context essential for understanding indicators. For example, the level of car use could be used as an indicator of prosperity, mobility or environmental damage
- Geographical systems and maps for plotting different data sets are useful.

Source: adapted from Local Government Management Board, United Kingdom (47)

While the target audience must be identified and the message tailored to it, the following principles may be useful in general presentations on indicators:

Box 8

FACTORS FOR PRESENTATION OF INDICATORS

- A brief discussion of the issue
- A statement of the policy objectives
- An indication of links with other issues and indicators
- A definition of the indicator
- An idea of the availability of data for the indicator and of action to remedy any deficiencies
- Interpretation of the indicator, including trends and explanations
- A rating of performance against any targets or milestones that may have been set
- Ideas for action to bring about change and identification of those responsible.

Source: Local Government Management Board, United Kingdom (47)

LEVELS OF ASTHMA

Description

This indicator reflects levels of asthma in the population. It shows the number of bronchodilators prescribed for treating breathing difficulties (corrected with an age weighting) per month averaged for the particular year in Leicestershire (no data are available for the City of Leicester).

(cont'd)

Importance

There has been a recent sharp increase in the diagnosis of asthma, particularly amongst children. In an attempt to explain this epidemic attention has been focused upon several factors including increased levels of air conditioning and the prevalence of the house dust mite. A consensus does, however, appear to be emerging which links asthma with a deterioration of air quality, particularly in urban areas. Nitrogen dioxide, a pollutant from petrol and diesel engines, is thought to exacerbate asthma and emissions of this pollutant into the atmosphere have been increasing as a result of traffic growth. The effects of environmental factors such as air quality on health have long been recognised and a sustainable society would be one living in surroundings with minimal pollution and threats to health.

Interpretation and trends

The prescription of bronchodilator drugs in Leicestershire has shown a steady increase in recent years. This has probably been partly due to increased levels of asthma diagnosis as a result of increased awareness of the symptoms and availability of treatment, but it also reflects a real increase in the levels of asthma. Such an increase probably reflects a deterioration in air quality and means a reduction in the quality of life of asthma sufferers. The trend represents **a movement away from sustainability.**

Recent increases in levels of asthma in children have been more pronounced. In Leicester, a small study indicated that the incidence of asthma in 9 year old children increased from 10% to 15% over a 10 year period between the early 1980's and the early 1990's, with up to 20% of children suffering in some inner city areas. Larger scale trials are planned.

Implications and action

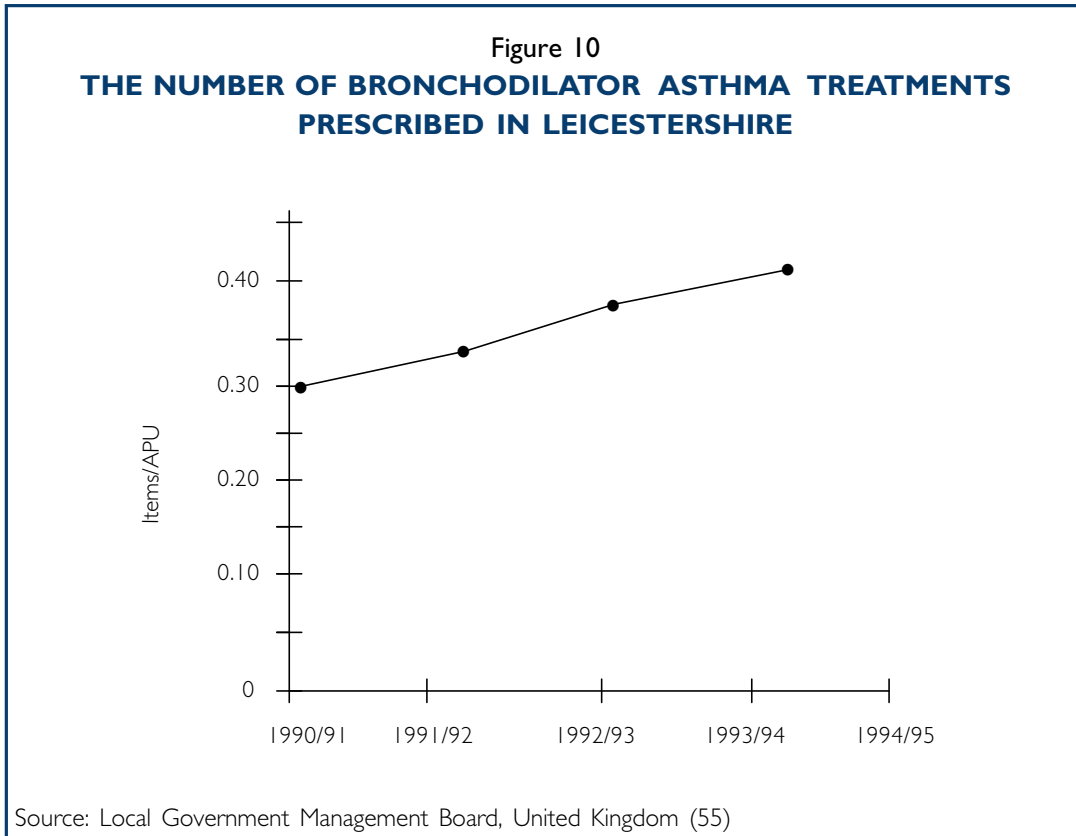
It is not yet possible to state conclusively that air pollution is creating asthma. However, it is certain that air pollution is worsening the suffering of those who have asthma and therefore effectively increasing the effects of asthma in Leicester. Following the precautionary principle action should be taken to improve air quality and (hopefully) reduce asthma, for instance through transport planning measures designed to decrease pollution. This should not rule out the exploration of other avenues that might also benefit asthma sufferers.

Measurement and source

Definition: The number of bronchodilators prescribed (corrected for age using the Astro PU weighting) monthly from April in Leicestershire averaged for the year.

Source: Public Health Directorate, Leicestershire Health, Gwendolen Road, Leicester LE5 4QF.

Geographical Applicability: Leicestershire



4.7 EXAMPLES OF INDICATOR CONSTRUCTION

In the following section, examples are presented to illustrate the way in which some of the technical issues outlined above might be approached in the construction of indicators. Different issues are emphasized in the various examples, derived from the Framework and Methodologies for Indicators of Sustainable Development compiled by the Commission for Sustainable Development (30, currently being updated). While the examples given are intended to illustrate the *issues* involved, the indicators themselves constitute no “best practice”. Many different indicators could be used in each cases discussed below. Further examples of environmental health indicator construction can be found in Briggs (43).

EXAMPLE: BASIC SANITATION

Indicator: percentage of the population with adequate excreta disposal facilities.

Definition of indicator: proportion of the population with access to a sanitary facility for human excreta disposal in the dwelling or in its immediate vicinity.

Unit of measurement: a percentage.

Measurement variables: the term “sanitary facility” should be defined, for instance as “a unit for the disposal of human excreta which isolates faeces from contact with people, animals, crops or water sources”. The facilities could range from simple, protected pit latrines to flush toilets with sewerage. The population covered could be defined as that served by connections to sewers, household systems (pit latrines, septic tanks) or communal toilets. The term “immediate vicinity” should also be defined, perhaps as any sanitary facility within 50 metres of a dwelling.

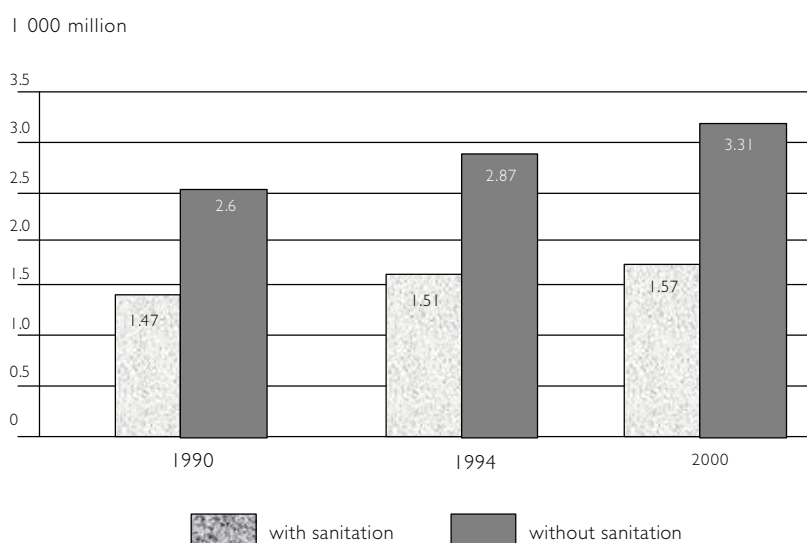
Purpose: the purpose of this indicator is to monitor progress in the access of a population to sanitary facilities. It is important to assess access to adequate excreta disposal facilities, as this is linked fundamentally to the risk for faecal contamination and disease and ill-health among the population. When disaggregated by geographical area or by socioeconomic status, it also provides evidence of inequalities.

Users would include sanitary engineers, planners, public health officials, non-governmental organizations and others.

Linkages: the indicator could be linked to other indicators, such as the proportion of the population with access to adequate and safe drinking-water, or to a health effects indicator such as mortality and morbidity from diarrhoeal diseases.

Data requirements: data could be obtained from censuses or special surveys and should be disaggregated by (for example) geographical area or urban-rural divide.

Figure 11
POPULATION WITH AND WITHOUT SANITATION,
ALL DEVELOPING COUNTRIES



Source: WHO (7)

EXAMPLE: ACCESS TO SAFE DRINKING WATER

Indicator: percentage of the population with safe drinking-water available in the home or within reasonable access.

Definition of indicator: the proportion of people with access to an adequate amount of safe drinking-water in a dwelling or within a convenient distance from the dwelling.

Unit of measurement: a percentage.

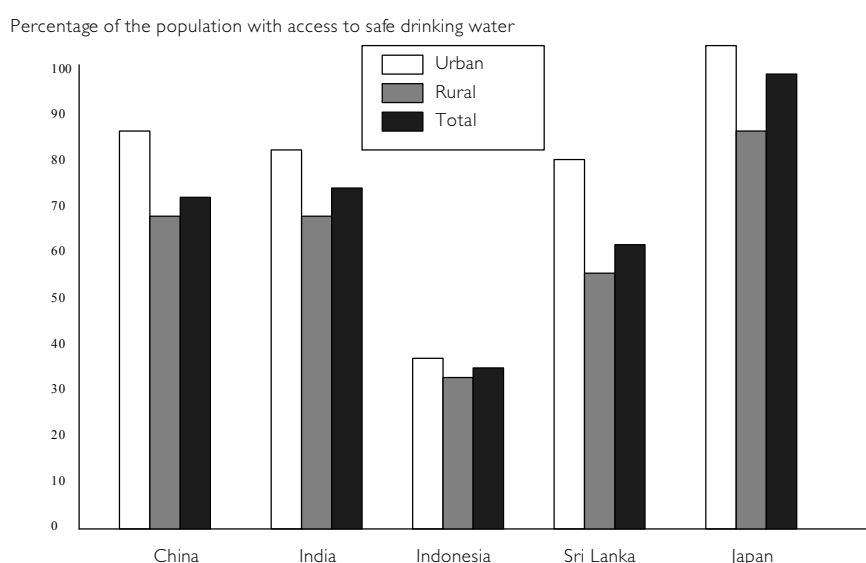
Measurement variables: definitions should be provided of the population covered and “a convenient distance from the dwelling” (for example water supply within 15 minutes’ walking distance). These definitions may differ in rural and urban areas. For example, 200 metres from a home may be a reasonable measure in an urban environment, but in a rural context access might be better defined in terms of the proportion of the day spent fetching water. Other aspects to be defined would be an “adequate amount of water” (for example, 20 litres per person per day) and safe water, which could include treated surface waters and untreated but uncontaminated water, such as that obtained from protected boreholes, springs and sanitary wells. Untreated water such as in streams and lakes could also be included if the quality of the water complies with health standards or with guidelines for drinking-water.

Purpose: this indicator is intended to monitor progress in the access of a population to safe drinking-water. This is relevant because access to unsafe drinking-water is associated with faecal contamination and risk for infectious disease.

Linkages: the indicator could be linked to other indicators, such as the proportion of the population covered by adequate sanitation, various indicators of the state of the environment related to water or to health outcome indicators such as mortality and morbidity from diarrhoeal diseases.

(cont'd)

Figure 12
ACCESS TO SAFE DRINKING WATER IN SELECTED COUNTRIES
IN ASIA, 1990



Source: World Bank (52)

Data requirements: data would be needed on the number of people with access, the total population, the source of the water, etc. These could be obtained from censuses and special surveys and should be presented in a disaggregated form when possible, for example, by geographical area, urban-rural divide or type of water source.

EXAMPLE: AIR QUALITY

Indicator: ambient concentrations of air pollutants in urban areas.

Definition of indicator: concentrations of ozone, carbon monoxide, particulates, sulfur oxides, nitrogen oxides and lead.

Unit of measurement: parts per thousand million or parts per million for carbon monoxide or micrograms per cubic metre of air for lead.

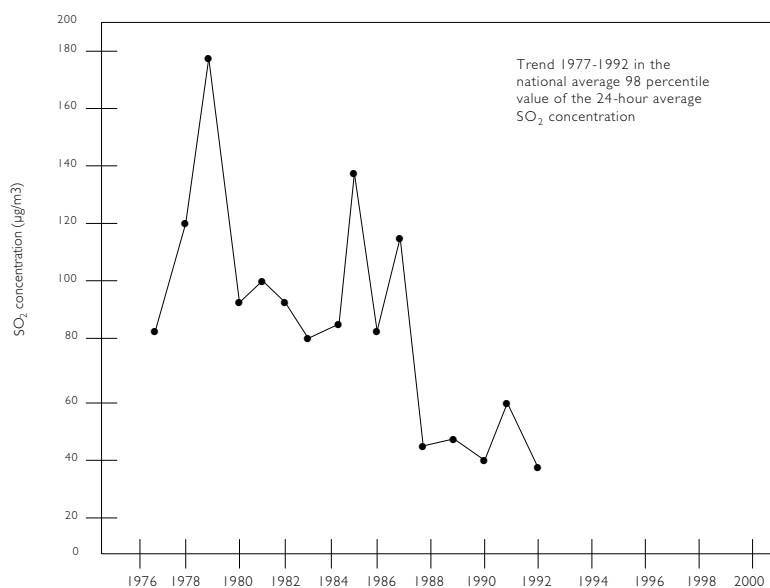
Purpose: this indicator might be used to evaluate overall air quality as a measure of the state of the environment and an indirect measure of the exposure of the population to air pollution. The information is relevant to controlling sources and to monitoring trends, particularly in relation to air quality standards, in order to safeguard human health.

Linkages: the indicator could be linked to indicators of annual energy consumption and air pollutant emissions or to a health effects indicator such as mortality and morbidity from respiratory illness.

Data requirements: the required data on temporal and spatial variations in concentrations might be obtainable from national and local health and environment agencies, from international agencies involved in monitoring or from non-governmental organizations. The methods should be specified for sampling, monitoring (for example passive and active sampling) and chemical analysis.

Figure 13

TRENDS IN SULFUR DIOXIDE CONCENTRATIONS, 1977-1992



Source: van de Water and van Hertem (34)

EXAMPLE: GREENHOUSE GASES

Indicator: emissions of greenhouse gases.

Definition of indicator: national anthropogenic emissions of carbon dioxide, methane and nitrous oxides.

Units of measurement: gigagrams for carbon dioxide and the conversion of methane and nitrogen oxide into carbon dioxide equivalents, with global warming potentials.

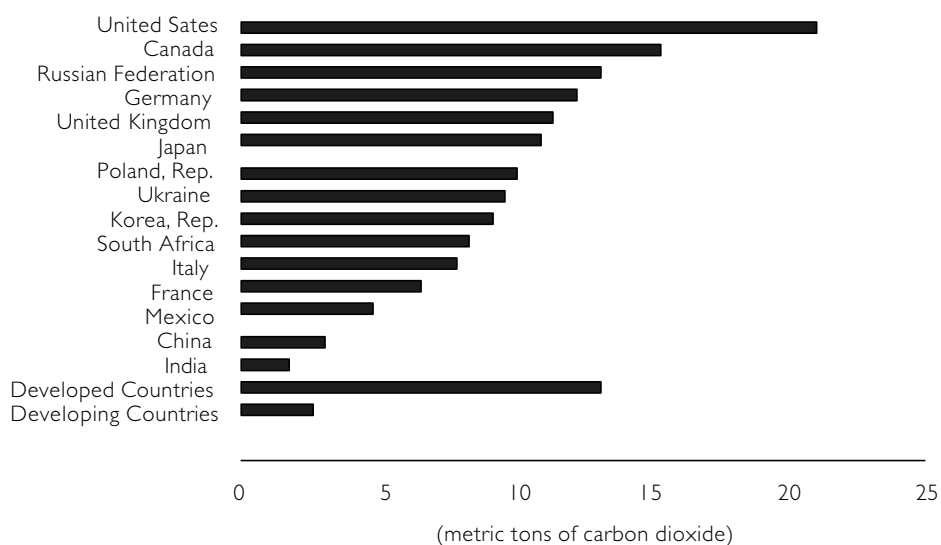
Purpose: measurement of the contribution of anthropogenic emissions to global warming. The relevance would lie in their contribution to climate change and their potential direct and indirect effects on human health and well-being.

Linkages: these might include indicators of environmental protection expenditure, expenditure on air pollution abatement equipment and indicators of pressure on the environment such as annual per capita energy consumption.

Data requirements: calculation of national greenhouse gas emissions in carbon dioxide equivalents and of emission levels, using factors associated with the emission of each gas for relevant activities. For example, data could be obtained from the parties to the Climate Change Convention.

Figure 14

PER CAPITA EMISSIONS OF CARBON DIOXIDE FOR THE 15 COUNTRIES WITH THE HIGHEST INDUSTRIAL EMISSIONS, 1991



Source: World Resources Institute (2)

EXAMPLE: LEAD POISONING

Indicator: raised blood lead concentrations in children.

Definition of indicator: the proportion of children (for example in a suburb, city or country) with blood lead concentrations of 10 micrograms per decilitre and above.

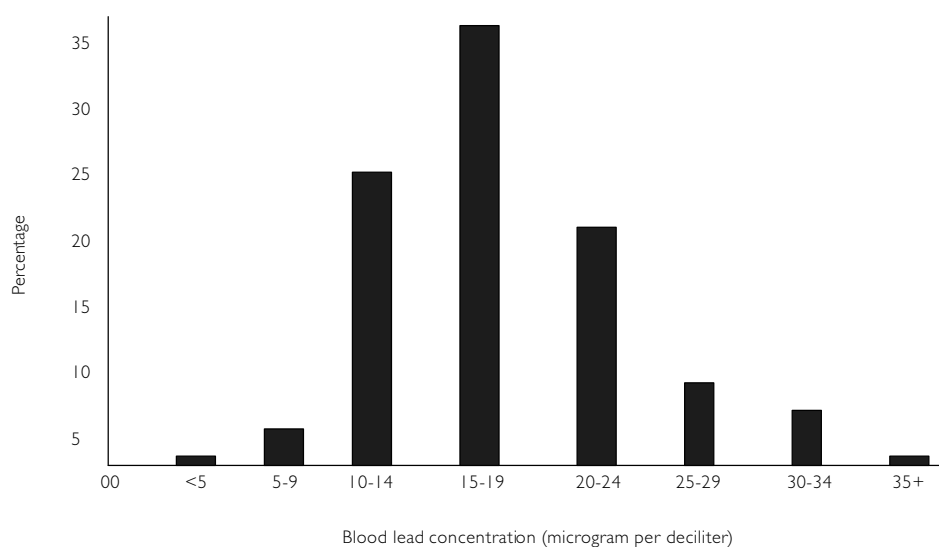
Unit of measurement: blood lead expressed in micrograms per decilitre ($\mu\text{g}/\text{dL}$).

Purpose: to meet concern about exposure to lead in children. This indicator would be used to assess the extent to which children's health is at risk from increased lead intake, possibly resulting from high concentrations of lead in the environment (air; water; soil, paint) and /or from their behaviour, such as pronounced hand-to-mouth activity, or "pica". The relevance of this indicator lies in the fact that children with raised concentrations of lead in their blood are likely to suffer from a range of health problems such as neurobehavioural disorders, reduced IQ or damage to various organs and systems, depending on the concentration.

Linkages: this indicator could be linked to other indicators associated with the quality of the environment and housing and to indicators such as socioeconomic status, since childhood lead exposure is prevalent in low-income groups.

Data requirements: the measurement methods that should be specified are those for blood sampling and analysis.

Figure 15
**BLOOD LEAD CONCENTRATIONS IN CHILDREN,
CAPE TOWN, SOUTH AFRICA**



Source: von Schirmding *et al.* (57)

5

INTERSECTORAL PLANNING FOR HEALTH AND SUSTAINABLE DEVELOPMENT

The process of the development of indicators has technical as well as social and political dimensions. Indicators for policy and planning should be developed as an integral part of the overall planning process at local and national levels. In this chapter, a brief account is given of intersectoral planning processes for health and sustainable development, including national health and environmental action plans and local “healthy cities” initiatives. Objectives of planning initiatives and partnership structures are also discussed.

5.1 INTERSECTORAL PLANNING INITIATIVES

As mentioned in Chapter 1, Agenda 21 laid much emphasis on the role of governments in fostering sustainability. While governments often bear the main responsibility for ensuring healthy living environments, they can do so only by working in collaboration and partnership with other stakeholders. Indeed, Agenda 21 called on governments to enter into dialogue with citizens, local organizations and private enterprises and to adopt Agenda 21 plans of action. The traditional service roles of government, the private sector, community organizations and trade unions have changed rapidly in recent years as a result of fiscal constraints, constitutional and legal reforms, scarcity of resources, globalization of economies and liberalization of markets (18). Governments have thus understood the need to adopt a partnership approach to service provision and planning.

While pressures of globalization continue to increase, a counteracting force of “localization” is emerging (58). New participatory approaches and strategies take account of the fundamental importance and central role of local communities in bringing about change. A global trend has emerged towards decentralized government services and greater emphasis on health and environmental actions by non-governmental organizations and by the community itself.

The involvement of all sectors of the community is regarded as fundamental for ensuring that programmes reflect local priorities, enjoy widespread support and are sustainable. Holistic, intersectoral approaches and a harmonization of strategies at all levels are needed to address the economic, environmental and social dimensions of sustainable development and to engage all relevant partners in cooperative planning (see Section 1.4). Of course, the problems to be addressed, the way in which services are delivered and the ways in which governments are organized differ considerably throughout the world. In most countries, a range of agencies and sectors are responsible

for aspects of environment and health at different levels of government. A precise delineation of sectoral responsibilities at various tiers of government is needed, based on integrated, intersectoral policies and plans.

5.2 NATIONAL INITIATIVES

After the United Nations Conference on Environment and Development (UNCED), numerous countries developed national and local plans for sustainable development, many of which addressed the development of indicators in planning their action within Agenda 21 and their reporting on the state of the environment. As mentioned in Chapter 1, many initiatives have been started which aim to incorporate health issues in sustainable development planning. One example is the development of national environment and health action plans, which have served as a blueprint for setting priorities for action in some countries. Perhaps even more important is the intersectoral collaboration that has been encouraged by the national environment and health action plans. Alliances and linkages have been formed with many different sectors, including planning, environment, transport, agriculture, water and energy. This has led to better understanding of the importance of development issues in ministries of health and of health issues in other ministries (9).

It is now increasingly recognized that the health sector has a key role to play in ensuring that the policies and strategies of all sectors and organizations contribute to health protection and promotion (see Section 1.4 for a brief discussion). The first regionally coordinated action for national planning for health and the environment was taken in the European Region, at a meeting of ministries of health and the environment held in Frankfurt, Germany, in 1989. The meeting adopted the “European Charter on Health and Environment” (4) and decided that a review of the key threats to health and the environment in Europe should serve as the foundation for future national and regional preventive action. The review was produced in 1995 and included a detailed analysis of the environment and health problems facing Europe in the coming years.

A follow-up meeting of the same ministries was held in Helsinki, Finland, in 1994, where it was decided that WHO Member States in Europe should prepare national environment and health action plans. A declaration on “Action for Environment and Health” in Europe was adopted. The third European Conference on Environment and Health was organized in London, United Kingdom, in 1999 to follow up the national and international activities initiated by the Helsinki Declaration (59). This resulted in adoption of the “London Declaration on Environment and Health”. A number of national environment and health action plans have now been formally approved by governments, and many more are in various stages of development.

In 1995, the Pan-American Conference on Health and Environment in Sustainable Development was held in Washington DC, USA, which resulted in the Pan-American Charter on Health and Environment in Sustainable Human Development (60). A regional plan of action was developed to serve as a guide to implementation of the Charter in

particular national situations. The Charter and plan of action formed the basis for the development of national plans and policies on health and the environment. A number of governments adopted formal political commitments and formulated national action plans on health, the environment and human development. For example, the Central American countries drafted a declaration on ecology and health, signaling their interest in reaching a consensus among the various national sectors with regard to health, the environment and development.

In the Eastern Mediterranean Region, following a conference on health, environment and development held in 1995, the “Beirut Declaration on Action for a Healthy Environment” was signed by the ministers of health and of the environment of the Member States of this Region (61). A regional strategy for health and the environment was adopted, and a number of countries are adopting national environment and health action plans. In South-East Asia, too, a regional strategic plan for health and the environment was prepared to promote the development of national plans of action. Health and environment initiatives have been introduced in all the countries of the Region (1).

In the Western Pacific Region, the approach has been to develop national health plans incorporating health and environment aspects, rather than to draw up separate national environment and health action plans. In Africa, a successful conference on health and the environment, held in 1997, led to the “Pretoria Declaration on Health and Environment in Africa”, which will serve as a basis for the development of integrated national planning initiatives. Work has already been started in a number of African countries.

In 1993, WHO in cooperation with UNDP undertook a global initiative whereby governments were encouraged to incorporate health and environment considerations in their national planning (62). Part of this work consisted of an evaluation of existing interministerial coordination and development options for establishing formal relationships between ministries and agencies, ensuring that health and environment sectors are represented on inter-ministerial committees for sustainable development. Raising awareness of the importance of health and environment in the various sectors was an important component of this work, as was the promotion of intersectoral action and strengthening the role of the health sector in planning for sustainable development (62).

WHO/UNDP GLOBAL INITIATIVE ON NATIONAL PLANNING FOR HEALTH AND SUSTAINABLE DEVELOPMENT

In Jordan, an intersectoral working group was set up by the Ministry of Health, and a national action plan for health and the environment was prepared. As part of this effort, the health and environmental implications of planned developments were assessed, measures to mitigate negative impacts were recommended and capacity-

(cont'd)

building initiatives for health and environment planning and implementation were developed.

In Guatemala, a working team was established with representation from the Ministry of Health and the planning and environment sectors, and a national plan for environmental health and sustainable development was produced, accompanied by an institutional analysis of national sectors associated with health and the environment.

In Guinea-Bissau, a national interministerial committee on health and the environment was established in order to foster a national process of coordination among agencies, government and civil society that would be conducive to the integration of health and environment concerns in overall national sustainable development planning. A national plan of action on health and the environment for sustainable development was produced.

In the Islamic Republic of Iran, a draft strategy document on health and the environment was developed for subsequent incorporation in a national strategy on sustainable development. The draft strategy included a situation analysis and proposals for structural and institutional reform.

In Nepal, a health perspective was added to the draft environmental policy and action plan, which originally had not included a public health component. Through the Nepal Environmental Health Initiative, a comprehensive strategy for health and the environment was developed and most of the recommendations were incorporated into the final environmental policy and action plan.

In the Philippines, collaboration was strengthened between health agencies and the Philippine Council for Sustainable Development, which oversees implementation of the commitments to sustainable development made at the Earth Summit. An inter-agency committee on environmental health organized by the Ministry of Health joined with the Council in sponsoring a detailed analysis, with case studies, of integration of health and environmental issues into the development and implementation of national plans for sustainable development.

Source: WHO (62)

UNITED KINGDOM NATIONAL ENVIRONMENTAL HEALTH ACTION PLAN

The United Kingdom National Environmental Health Action Plan, intended to improve environmental health in the United Kingdom, set out ways in which improvements could be made and identified the sectors responsible. It contains more than 160 actions for improving environmental health in the country, with a checklist against which progress can be measured. The Government intends to review the project from time to time and to report on the extent to which the actions set out in the plan have been completed.

(cont'd)

In drawing up the plan, the views of a wide range of people were taken into account. A draft plan was published in 1995, and nearly 250 people and organizations responded to the invitation to comment on it. The replies offered many constructive criticisms, which were taken into account in the plan. The format set out five areas:

- Institutional framework
- Environmental health management tools
- Specific environmental hazards
- Living and working environments
- Economic sectors

The objectives, bases for action and actions were set out for each of the areas covered by the plan. The actions were divided into three types according to their urgency, namely basic requirements, prevention and control of medium- and long-term hazards and promotion of well-being and mental health.

All in all, the plan gave both an overview of the provision of environmental health and a detailed analysis of the main factors contributing to it. It showed how the existing provisions could bring about a steady improvement in environmental health or how they should be modified to do so, setting out a range of specific actions which may be needed. In this way, the means of achieving the objectives of the action plan are established.

Source: Department of the Environment, United Kingdom (63)

5.3 LOCAL INITIATIVES

In addition to intersectoral planning initiatives at the national level, much work has been done at the local level. Chapter 28 of Agenda 21 states that “... because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the participation and cooperation of local authorities will be a determining factor in fulfilling its objectives. As the level of government closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development”. While it may not be fully understood how or if sustainable development can be achieved, it is generally agreed that it must be achieved at a local level if it is to be achieved at a global level (18).

Box 9

LOCAL GOVERNMENT RESPONSIBILITIES

Local authorities:

- operate the economic, social and environmental infrastructure
- oversee planning processes
- establish local policies and regulations
- determine parameters for economic development, and
- represent important vehicles for the development and implementation of local, regional and national policies.

Source: International Council for Local Environmental Initiatives (18)

Since 1992, thousands of local authorities throughout the world have responded to the local Agenda 21 mandate by developing their own action plans, many of which feature health and health-related objectives and activities. A number of international, regional and local initiatives and networks to improve conditions in cities have emerged, involving WHO as well as other United Nations agencies such as UNCHS, UNDP, UNEP and the World Bank. Previous examples include the WHO Healthy Cities Project (65, 66, 67), the LIFE programme of UNDP, the UNDP/World Bank/UNCHS urban management programme, the Sustainable Cities programme of UNCHS/UNEP, the CITYNET/Asia Pacific 2000 programme of ESCAP/UNDP, the Megacities programme, the Model Communities programme of the International Council for Local Environmental Initiatives and many others. In Europe in 1994, the “European Sustainable Cities and Towns Campaign” was set up to help local governments introduce local Agenda 21 processes in their cities.

An attempt to bring these various movements together is reflected in increasing numbers of international meetings to address such issues as healthy and sustainable cities, environmentally sound and healthy cities and so forth, to improve the integration of environment, social, economic, health and land-use planning at the local level.

**LOCAL AUTHORITIES WITH LA21 STRATEGIES
IN THE UNITED KINGDOM**

Background

An LA21 strategy is a local action plan for sustainable development. Most LA21 processes are led by the local authority with broad involvement by the local community. Strategies should inform all other local plans, policies and programmes.

Relevance

Action at a local level is essential. Local authorities have a vital role in delivering a better quality of life, particularly through the development of sustainable communities.

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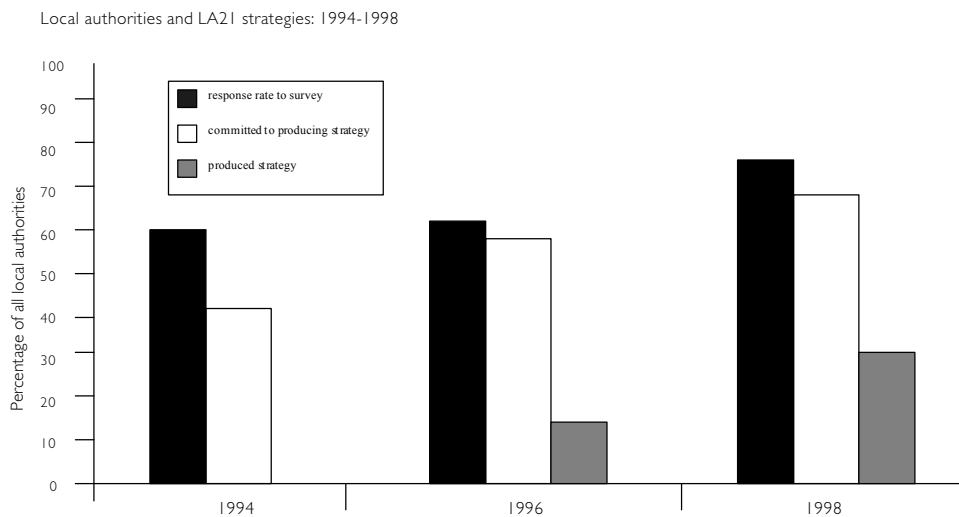
Targets and goals

The Prime Minister has set a target for all local communities in the UK to have LA21 strategies in place by the end of 2000.

Trends

The number of local authorities known to be committed to producing strategies has increased from 41% in 1994 to 67% in 1998. Many authorities are developing indicators to complement their strategies. A recent survey for the Improvement and Development Agency (IDeA) showed about a half of all local authorities in the UK to be developing sustainability indicators.

Figure 16
NUMBER OF LOCAL AUTHORITIES WITH LA21 STRATEGIES
(UNITED KINGDOM)



Source: Local Government Management Board, United Kingdom (55)

Sustainable Cities

The United Nations Centre for Human Settlements (UNCHS/Habitat) has been directing a Sustainable Cities programme since 1989, in collaboration with UNEP. The main goal of this project is implementation of Agenda 21 at the local level, and it is currently working with local governments in Africa, Asia, Eastern Europe and Latin America. The ultimate aims are to develop participatory environmental management and planning practices, to encourage sound natural resource management and to reduce environmental hazards that threaten the sustainability of urban growth and development.

The first global meeting on implementing the urban environmental agenda took place on the eve of the Habitat II Conference and defined a common agenda for development and international support for the future. The meeting reflected the impressive range of initiatives and accomplishments in urban environmental management world-wide

and the resources and expertise, local and international, that has been mobilized and effectively used. Strategies were recommended to improve environmental information and technical expertise, implementation of policies and strategies, institutional and participatory capacity and use of scarce resources for bringing about change. The meeting resulted in the adoption of the Istanbul Manifesto, which will help cities and programmes to follow-up and implement the global and national plans of action. It is also seen as an important step in the global support activities which will define local efforts and international cooperation concerning the urban environment (68, 69).

Model Communities

The International Council for Local Environmental Initiatives created a local Agenda 21 initiative which included a research programme in selected cities aimed at developing tools and models for sustainable development training, and a larger network of local governments and their partners that have undertaken planning for sustainable development. A local Agenda 21 planning guide developed in 1996 describes a number of health-related issues that should be taken into account in analysing community-based issues (18).

Healthy Cities

The concept of addressing local issues in partnership with interested parties is also reflected in the Healthy Cities movement initiated by WHO over a decade ago (6, 65, 66, 67, 70, 71, 72, 73). Healthy cities projects are diverse, some addressing city-wide community development initiatives with a planning emphasis and others addressing implementation of specific community-based projects. The project is deliberately political and process-orientated, promoting political commitment and advocating fundamental change in local government and its relationship with communities (73). The approach is particularly relevant in countries where health is not a local government function. Indeed initiatives for healthy communities and healthy cities have been especially successful in Canada and the United Kingdom, where public health functions were placed with regional authorities.

Networks of cities have been formed in all regions of the world (72). City “twinning” initiatives have become common and are based on relationships between cities with particular ties of language, culture, level of development or political history. An approach used in Europe has been to develop Multi-city Action Plans, in which networks of cities simultaneously address a particular issue such as tobacco or a condition such as asthma. The Healthy Cities concept has also been applied to a number of rural areas as Healthy Villages projects (74).

5.4 OBJECTIVES OF INTERSECTORAL PLANNING INITIATIVES

In some national health and environmental action plans, Agenda 21 initiatives and other intersectoral planning initiatives, a rational and comprehensive process will have been set in motion, while in others planning may have been done in a more incremental way. Nevertheless, the common elements are a partnership approach and the following of certain steps, not necessarily in a linear order. Indeed, the process is often circular: for example, the initial definition of the problems may be altered as a result of participants' perceptions, which may change with time.

The objectives of the planning initiative might include creation of a shared vision of the future, identification and ranking of key issues, development of action plans, mobilization of resources and ways of increasing public support (18).

Since planning is valuable only if it leads to action, it is vitally important to identify the subject of concern, the geographical parameters of the planning initiative, the relevant jurisdictions, the time frame and the availability of resources (18). These factors will determine the scope of the planning initiative. Initiatives often fail because those responsible make them too comprehensive, not fully realizing the type or amount of resources needed to implement plans. The setting determines the problems to be addressed, the type of information that is relevant, the formality of the consultative process, the nature of public participation and so forth. A neighbourhood effort will differ from a city-wide effort, which in turn will differ from a national or regional effort, or an effort tailored to a setting such as a school. It is often useful to draw up a formal statement of what is hoped to be achieved.

In the United Kingdom, the Local Government Management Board has developed 13 themes for sustainable development in order to provide a better understanding of the concept.

THEMES FOR SUSTAINABLE DEVELOPMENT: A VISION

A sustainable community is one in which:

- Resources are used efficiently, waste is minimized and materials are recycled
- Pollution is limited to levels that do not cause damage to natural ecosystems
- The diversity of nature is valued and protected
- Local needs are met locally where possible
- Everyone has access to adequate food, water, shelter and fuel at a reasonable cost
- Everyone has the opportunity to undertake satisfying work in a diverse economy; the value of unpaid work is recognized and payment for work is both fair and fairly distributed

(cont'd)

- Health is protected by the creation of safe, clean and pleasant environments and of services which emphasize prevention of illness as well as care for the sick
- Access to facilities, services, goods and other people is not achieved at the expense of the environment or limited to those with cars
- People live without fear of crime or of persecution on account of their race, sex, sexuality or beliefs
- Everyone has access to the skills, knowledge and information that they need to play a full part in society
- All sections of the community are empowered to participate in decision-making
- Opportunities to participate in culture, leisure and recreation activities are readily available to all
- Buildings, open spaces and artefacts combine meaning with beauty and utility, settlements are “human” in scale and form, and diversity and distinctive local features are valued and protected.

Source: Local Government Management Board, United Kingdom (55)

A similar exercise was undertaken by the Healthy Cities project in Europe.

VISION OF A HEALTHY CITY

A city should strive to provide:

- A clean, safe physical environment of high quality (including housing quality)
- An ecosystem that is stable now and sustainable in the long term
- A strong, mutually supportive, non-exploiting community
- A high degree of participation and control by the public over decisions affecting their lives, health and well-being
- The basic needs (for food, water, shelter, income, safety and work) of all the city's people
- Access to a wide variety of experiences and resources, with chances for a wide variety of contacts, interactions and communication
- A diverse, vital and innovative city economy
- Encouragement of connections with the past, with the city-dwellers' cultural and biological heritage and with other groups and individuals
- A form that is compatible with and enhances the above characteristics
- An optimal level of appropriate public health and care services accessible to all, and
- A high health status (high levels of positive health and low levels of disease).

Source: WHO (73)

The city of Kuching, Malaysia, provides an example of such a vision statement:

VISION FOR KUCHING, MALAYSIA

“A well planned, vibrant, landscaped garden city, endowed with a rich artistic, scientific and educational culture. A bustling city with a flourishing and resilient industrial economy, yet clean, unpolluted. A safe city, offering a standard of living affordable by all its citizens. A city managed efficiently and enjoying state-of-the-art communication, information and mass transport technology and providing ready access to services, utilities and recreation areas. A city that is dynamic and attentive to its people’s needs and constitutional rights”.

Source: WHO (75)

5.5 PARTNERSHIP STRUCTURES

A wide variety of partners are becoming involved in all stages of policy-making and implementation, from the initial definition and prioritizing of issues to the collection and analysis of information and the development and implementation of plans. To ensure that long-standing commitments are met, it is important that partners be properly involved in the definition and solution of problems. The concerns, needs and preferences of all relevant, interested and affected parties, including the service users, must be articulated. Local partners contribute their knowledge, expertise and perceptions of problems and can often benefit by gaining a better understanding of the technical and financial constraints that might have a bearing on plans to be developed in the future. In order to formulate plans and to construct indicators for environment, health and development concerns in the process, experience has shown that it is necessary to set up a structure within which partnership arrangements may operate.

PARTNERSHIPS FOR POVERTY ALLEVIATION IN CEBU CITY, PHILIPPINES

“The city of Cebu initiated major changes in city governance to work with poor urban communities and to provide them with services. An enabling partnership among city government departments, community-based organizations, non-governmental organizations and the private sector was established in 1988. The strength of this partnership allowed the Government to address several areas of concern to poor urban communities, including improvements in health, education and social services, expanded training programmes and extension of credit to the informal sector and poor urban groups. In addition, employment and apprenticeship were increased in collaboration with the private sector, and there was a marked improvement in land

(cont'd)

tenure and security, as well as the development of special services for street children, single mothers and the disabled”.

Source: United Nations (76)

The nature of any partnership depends on the scope of the planning initiative, its goals and objectives. The initiating institution (for example the local municipality), in consultation with potential partners, might form a preliminary stakeholder group which could be broadened after a more formal consultation, which might proceed through a series of workshops with identified target groups (18). It is important that the membership be broad-based in order to facilitate the involvement of as many relevant sectors as possible. It is also essential to have a clear mandate and authorization from the government body concerned, in order to establish democratic accountability and a link with the government’s planning activities.

The structure of the partnership has been found to be critical in terms of providing political links and direction and the form for facilitating intersectoral coordination and community participation. Adapting committee structures to facilitate links with existing political and community structures has been found to be important. Stakeholder groups can range from roundtables and fora with relatively short-term mandates to more formal statutory committees and councils with long-term mandates. They can be formed either within or outside an existing government structure.

Examples of such stakeholder groups include the Lancashire Environment Forum in the county of Lancashire, United Kingdom, the Inter-institutional Consensus-building Committee of Cajamarca, Peru, the Popular Citizen Councils of Santos, Brazil, the Consultative Committees of Johnstone Shire, Australia, and the many Healthy Cities partnership structures that have been set up (18).

The formation of an intersectoral committee nevertheless does not by itself guarantee success, as was experienced in Liverpool, United Kingdom, where such a committee was formed from 10 partner agencies and was supported by a highly proficient technical committee (77). One of the problems encountered was the absence of any distinction between executive and representational functions on the committee; these were organizationally separated later, and community and voluntary sector representatives were asked to contribute instead to topic forums, which in turn elected representatives to the intersectoral committee.

Once the formal stakeholder group has been formed, it has been found useful to establish more specialized working groups to deal with particular issues, which could be structured along district or neighbourhood boundaries or be divided according to responsibility for various elements of the planning process, such as issue identification, action planning or evaluation. This is often an important component of the intersectoral effort, since it is difficult to sustain the interest and involvement of groups with such diverse interests and backgrounds. Specialized working groups can help to focus the interests and energies of disparate groups. At the national and local levels, many countries have established intersectoral committees to follow up

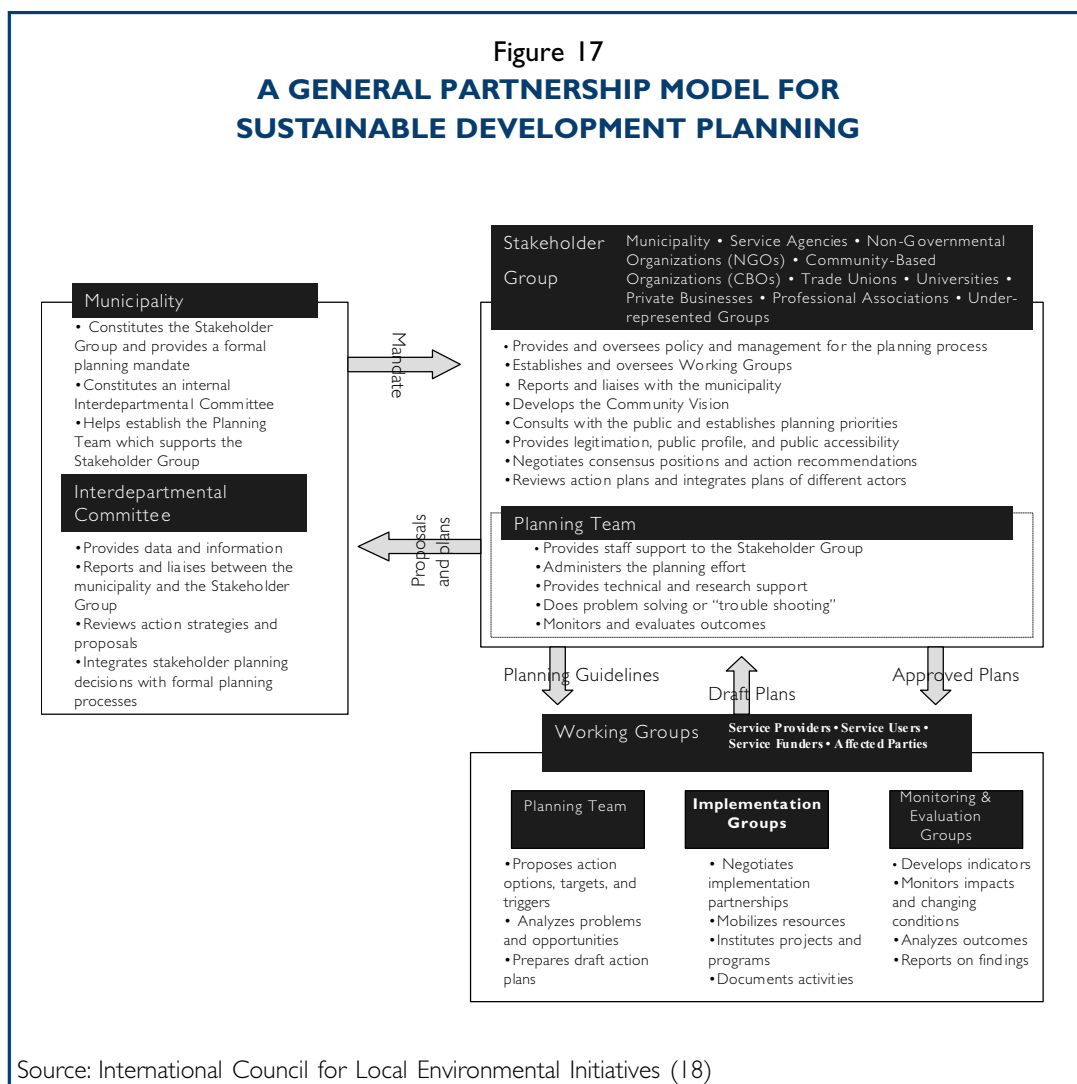
Agenda 21. Through these forums, including the task forces and working groups set up to address specific issues, the health sector has been able to exert a significant influence.

Identification of Partners

Identification of the right partners is a crucial step, as it determines the legitimacy of the initiative and the ability to develop new insights, ideas and approaches and to establish consensus. A general principle to be followed is that service users and providers should be represented, as well as other interested and affected parties and parties with particular knowledge and expertise. Partners should have a vested interest in the problems and should be interdependent in reaching solutions.

Potential Partners include:

- Business and industry
- Local, national and regional government
- Trade unions



- Community groups and residents
- Women's groups
- Youth groups
- Media

The many issues to be considered if such partnerships are to succeed are highlighted below.

Box 10

INGREDIENTS FOR SUCCESS OF PARTNERSHIPS

- The contributions of all partners should be understood and valued, and each partner should benefit by them
- The core interests of individual organizations should be protected
- Partners should be able to gain resources and/or legitimacy
- There should be opportunities for action and the capacity for action
- There should be a clear mandate and authorization from the government body concerned, in order to ensure democratic accountability
- There should be a link with the government's planning activities
- Agreements must be reached on how the results will be incorporated into the planning effort
- There should be a clearly defined decision-making process.

Source: various, in von Schirmding (9)

5.6 IMPLEMENTATION IMPLICATIONS

While the intersectoral plans have varied in scope, content and quality, the process has nevertheless been successful in promoting collaboration between sectors such as health and the environment and in developing mechanisms for the formation of partnerships. In many instances, however, the strategies have proved inadequate to involve planning and finance ministries or non-governmental organizations, despite a greater awareness of the problems of health and the environment in government, non-governmental bodies and communities. There is also wider recognition of the need for greater focus on prevention, and broader approaches are being used to address environment, health and development problems.

It may be necessary to reorganize and strengthen institutional mechanisms and to develop mechanisms for inter-jurisdictional cooperation in implementing policies and plans. Decentralization of structures may be needed to facilitate community and sectoral involvement and better coordination within and between government structures and other bodies. Substantial reform of services may be needed to facilitate the implementation of intersectoral plans.

Capacity development should be oriented to many different allied professions that can contribute to planning, policy formulation and implementation, as multiple skills are needed to address the multifactoral nature of environment and health problems. Local in-service training is particularly important in view of the world-wide trend to decentralization, in which powers and functions have been transferred to the local level but sufficient capacity to implement activities is often lacking.

There is also a need for integrated systems of information on health and environment, in order to link sectors and provide the results of scientific monitoring to support policy development and implementation. To keep decision-makers and the public informed about health and environment trends, including the preventable component of the disease burden, epidemiological surveillance and monitoring of the environment is vitally important. Mechanisms should be put in place to ensure that such information, once obtained, is transmitted to the various sectors for action. A framework for the collection of this information is given in Chapter 7.

6

INDICATOR DEVELOPMENT AND THE PLANNING CYCLE

In this chapter, procedural issues related to the development of indicators in the planning cycle are discussed. Examples are given of how indicators have been used in identifying and analyzing issues, in action planning and in the implementation, monitoring and evaluation of intersectoral plans.

6.1 INVOLVEMENT OF STAKEHOLDERS

Stakeholders should be engaged at an early stage of planning in order to promote wider ownership of indicators that are important at all stages of policy-making. The process of indicator development has itself proved to be an effective way of ensuring public participation in sustainable development planning. Communities and non-governmental organizations often have a major stake in developing indicators, not only for their own activities but also for ensuring that policies are implemented and that governments and other partners meet their obligations and remain accountable. This is normally most productive where communities and governments do their planning in partnership.

Many community-based organizations and non-governmental organizations have used indicators in funding applications, for example in establishing their bona fides, demonstrating their capacity to monitor and analyze, and showing their organizational success, responsiveness and accountability (32). In Canada, a sustainable community indicators programme was developed to assist communities in developing and using indicators to measure their progress towards sustainability. Software has been developed to help communities select, create and use indicators for monitoring and reporting on local sustainability, to promote the use of comparable indicators, both locally and at the national level, and to exchange indicators and related data with other communities (46).

In the development of indicators, various levels of participation may be achieved in the approaches chosen by the authority or community. These may include:

- a large working group to consider all the chosen indicators, with additional expertise in data gathering from the most appropriate sector
- choosing specific issue-based indicators and working in issue/sector working groups
- examining linkages between indicators across broad groupings and

encouraging different sectors to work together, and

- working with various community groups and individuals to tackle different issues independently, canvassing responses from constituents, pooling results to form an overall picture and reporting back to the authority. (47).

The nature of the issues addressed and the types of indicators required will determine how the partnership model highlighted in Chapter 5 could best be adapted or used for developing indicators.

6.2 ISSUE IDENTIFICATION AND ANALYSIS

As discussed earlier, adequate information is often not available to support decision-making and action based on the systematic identification of problems and assessment of priorities. Much experience has been gained from the national environment and health action planning process referred to in the previous chapter. The assessments of needs that serve as a basis for the plans, while far from perfect, have led to a better understanding of the nature and causes of environment and health problems in specific countries. Nevertheless, a number of weaknesses have been revealed, for example:

- Gaps in data availability and quality
- Difficulty in detecting trends (geographical and temporal)
- Difficulty in disaggregating data
- Poor linkages of health and environmental data and sectoral data
- Emphasis on symptoms rather than on causes of problems
- Little focus on analysis of management structures and capacity
- Lack of clarity in priority-setting processes

These apply to developing countries as well as to industrialized countries. Identification of issues and problems, assessment of needs and setting of priorities for the development of action plans are important areas in which indicators have a key role to play. Problems and issues should be defined in both qualitative and quantitative terms, and sectoral responsibilities should be highlighted. Sometimes a data-driven approach is used, in which prime consideration is given to issues that are measurable by existing means, while in other cases a more integrated approach is adopted, combining data and measurements with an intuitive process based on what people consider to be important (55).

The analysis of needs and the priority-setting process thus involves both the views of the communities involved (which fully express the local perception of the problems and issues) and a technical assessment based, for example, on available health statistics and known epidemiological links between health status and environmental and social conditions. A variety of methods and techniques can be used to engage partners in the identification of issues, development of indicators and data collection for indicators.

PUBLIC PERCEPTIONS OF SUSTAINABLE DEVELOPMENT IN LANCASHIRE, UNITED KINGDOM

Lancashire County Council commissioned the Lancaster University Centre for the Study of Environmental Change to carry out a carefully targeted consultation on its behalf. After some background research, eight focus groups were selected to represent widely varying sections of the community which were not already active in the consultative process. These were young men on training schemes, Asian women, mothers with young children, unemployed men, retired people, rural professionals, middle-aged working-class women and young professionals. The groups were selected from different parts of the county and met twice for 2-hour sessions, which were facilitated and recorded for later analysis.

The discussions focused on the following issues:

- identification with place
- current concerns and anxieties
- perceptions of the quality of life and identification of those responsible for it
- feelings about sustainability, the environment and indicators.

The results revealed anxieties about employment, crime, social cohesion and pollution and a widespread feeling of powerlessness in the face of these problems. Many of the personal concerns expressed were not quantifiable and thus not easily amenable to an indicators approach. Only two individuals in all eight groups were familiar with the term 'sustainable development', but the concept received support when it was explained to the groups.

There appeared to be strong identification with place in most of the groups, and environmental concerns were expressed, mainly in relation to local problems such as the state of local beaches or traffic and industrial pollution. Action to address these problems was impeded by a widespread cynicism and mistrust of public institutions (including local government). In addition, many members of the focus groups doubted the willingness of their local authority to bring about real improvements in the quality of people's lives. This in itself is likely to have important implications for future approaches to public participation in Lancashire, and indeed elsewhere. On this basis, however, the indicators process itself could help to restore trust on an open-ended basis.

Source: Local Government Management Board, United Kingdom (47)

These include community meetings, fora, focus group discussions and mappings.

Priority health and environmental issues for which indicators are needed naturally differ from one place to another and depend partly on the priorities and on the capacity for data collection and analysis in a country or community. Priorities may also change over time, particularly as different stakeholders with changing perceptions of problems become involved in the process, necessitating a certain amount of flexibility in the selection of indicators.

DEVELOPMENT OF A SET OF COMMON INDICATORS OF LOCAL ENVIRONMENTAL HEALTH CONDITIONS IN LUCKNOW AND CALCUTTA, INDIA

A project to develop local environmental and health indicators in the cities of Lucknow and Calcutta, India, incorporated the use of innovative techniques such as photography, mapping and drawing as well as community discussions in the selection of local health and environmental indicators. The indicators were developed by members of several communities who used various qualitative methods adapted to suit each setting. The common methods included discussions at household level, mainly with women, comprising questions about how they would like to see their environment improved, followed by discussion of the factors that would help or hinder their improvement. In Lucknow, photography was used by members of the communities to document existing problems and to show desired environments. Many of the concerns raised at this stage related to environmental services and especially to water, sanitation and solid-waste management. The photographs, maps and drawings were then used to stimulate discussion in larger group meetings, where the idea of indicators was introduced.

In Lucknow, residents were asked to imagine the position of service planners and to decide what factors should be monitored, while in Calcutta, residents were asked to decide what environmental factors should be measured. Perhaps as a result of this difference, the range of indicators developed in Calcutta was much broader than that developed in Lucknow. Although the indicators generally varied by settlement, age category, sex and socioeconomic group, a common set of indicators emerged across six neighbourhoods in the two cities.

In addition to the common indicators, a wide range of site-specific indicators was selected in each of the study sites. These reflected concerns about street lighting, indoor air pollution, pests and the social environment of the neighbourhood. Whereas outdoor air pollution was not a significant concern in any of the neighbourhoods, indoor air pollution, mainly related to cooking stoves, was a source of anxiety. Many of the community indicators involved behaviour, such as the way in which residents disposed of their solid waste, as well as service coverage (78).

These patterns of selection of common and site-specific environmental and health indicators across neighbourhoods and cities have implications for the large-scale use of indicators internationally and regionally. The study confirmed that residents' priorities can be ascertained and expressed as a set of indicators, and the residents felt that they were playing a useful role by identifying and advocating action to improve the environment.

Indicators Identified

- Percentage of households with individual piped water connections
- Percentage of households with access to sanitary latrines (temporary or permanent)

(cont'd)

- Percentage of households with sewerage connections
- Percentage of households with connection to drainage systems
- Episodes of flooding inside dwellings
- Percentage of households using bins to dispose of solid waste
- Percentage of households disposing of waste indiscriminately
- Regularity of sweeping in clearing solid waste
- Existence of a park or playing area in a neighbourhood
- Existence of community organization/facilities such as community halls
- Percentage of households cleaning the drain in front of their home
- Percentage of households participating in repairing tubewells, and
- Percentage of households using preventive measures against pests (mainly mosquitoes)

Source: Hunt *et al.* (78)

GREAT LAKES, CANADA

In a project to develop environment and health indicators in the Great Lakes region of Canada, consultative workshops held in four communities focused on the association between health and environmental issues related specifically to air quality. Throughout the planning process, every effort was made to involve local community groups in the design and content of the workshops, so that participants could clarify their interests, the most useful consultation methods and their own commitment to the process. Although this approach required more time and energy than simply holding workshops, it generated considerable community support and goodwill.

Through the advance provision of materials and resources, participants arrived at the workshops with a general understanding of, and familiarity with, indicators and air quality issues. The pre-registration materials enabled the principal investigators to learn about the specific community and participant interests that would be useful later in the workshop. In addition, the exchange of materials demonstrated to communities the commitment to an all-inclusive process and an intention to integrate the project in local experience and expectations.

The four stages of identifying local air quality indicators, applying them to health effects, analyzing their usefulness to the community and selecting the best indicators gave both participants and investigators an opportunity to explore a range of issues associated with health-based air quality indicators. The encouragement given to participants in listing their own indicators based on personal experiences, values and knowledge showed how well communities already understand the significance of environmental health issues.

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Regional air quality indicators had less relevance to the communities than local indicators. In developing community health-based indicators, a need was determined to correlate regional indicators with local indicators and clarify reporting and public response. In order for the public to understand information and to respond constructively, an index was suggested to measure impacts and changes in local terms.

Analysis of the questionnaires revealed that participants generally had a good understanding of the links between the environment and health and of indicators, with measurements before and after the workshop showing little difference. In contrast, both the participants' self-reported evaluations and statistical tests of an effect of the intervention showed a slight improvement in the communities' ability to assess the usefulness of indicators and a significant increase in their ability to use indicators to take action to improve air quality locally. The participants offered practical solutions for problems which in many cases remain only vague concepts for government and health agencies.

Source: Cole *et al.* (79)

Assessments based on technical and popular knowledge must be combined in developing indicators and can be used to reach consensus about local problems, to set priorities and ultimately to establish policies and plans. Once the initial issues are identified and their scope is ascertained, they must be assessed in greater detail in order to serve as a basis for action planning. Many tools are available to facilitate this process, including rapid environmental assessments, rapid epidemiological assessments, comparative risk analysis and other techniques. Information for indicators should be based not only on the state of the environment and human health (symptoms of the problem), but also on the systems that gave rise to the problems, with due regard for the long-term sustainability of actions and strategies. This implies taking economic, environment and social factors into account (see Chapters 7 and 8 for discussion of frameworks for examining links between health, environment and development issues).

A case in which existing data and community surveys were successfully used to reach a consensus on both the problems and the priority to be given them is the Healthy Cities project in Indiana, USA (80). Data available in the State were broken down by age, race and sex, and information on major trends in level of education, infant mortality, leading causes of death, crude birth and death rates and housing was presented to Healthy City committee members. This was supplemented by information from special community surveys and by information obtained through opinion surveys at health fairs, vision workshops and other mechanisms. The information laid the basis for prioritizing problems and for subsequently developing action plans.

In Barcelona, Spain, a health information system based on indicators was created to document the population's health problems and the effectiveness of the health services, through a combination of information on mortality and morbidity rates, hospital discharge diagnoses, air pollution levels, and subjective information on

community perceptions of health (81). Health statistics for Barcelona were used to draw attention to one of the poorest districts in which the infant mortality rate was the highest and life expectancy lowest, and programmes were targeted accordingly.

COTONOU, BENIN

Under the umbrella of the multi-country Health and Environment Analysis for Decision-making initiative, a field study on environment and health indicators was undertaken in Cotonou, Benin, by the Centre Régional pour le Développement et la Santé. In order to select environment and health indicators, routine statistical and epidemiological data from the health services were assessed, and patients' records were reviewed to determine the morbidity and mortality rates of common diseases. In addition, previous studies of environment and health were reviewed, and interviews were held with politicians and officials of the Ministry of the Environment. The population of Cotonou and the local authorities were invited to comment. The results of preliminary investigations indicated inequity in the distribution of the five most common diseases across Cotonou. For example, the rates of malaria and diarrhoeal disease were 12 times higher in one zone than in another.

Indicators selected:

- Percentage of the population with access to a sufficient quantity of safe drinking-water
- Percentage of people covered by public garbage removal services
- Percentage of people exposed to high concentrations of health-damaging air pollution (indoor and outdoor separately)
- Percentage of people covered by primary health care
- Percentage of the eligible population who are fully immunized according to the national immunization policy
- Prevalence of malaria
- Prevalence of intestinal helminths among children aged 2-15 years
- Percentage of people who obtain drinking-water only from unprotected, contaminated wells
- Percentage of people affected by constant flooding at home
- Percentage of people with adequate lighting at home.

Experience in Cotonou showed that a number of factors affected the selection and use of indicators.

These included:

- The high degree of environmental health inequity in Cotonou
- The need to improve the quality of routine data
- The need for cross-sectoral consultation and collaboration to improve the health and environmental information management system

(cont'd)

- The existence of an opportunity to increase community participation in the definition and assessment of environment and health indicators in Cotonou.

Source: Soton *et al.* (82)

6.3 ACTION PLANNING

The identification and analysis of priority issues form the basis for the subsequent development of policies and strategic plans of action, which might be multi-stakeholder agreements. In order to facilitate broad action, it is important to identify the action strategies and the commitments of the partners, so that they can work together in achieving the goals, objectives and targets of the action plan, which should be measurable commitments to be met in a specific time frame.

If stakeholders have not been properly involved in the development of the policy or plan, it may not be implemented, competing plans may be developed, and the whole process of implementation may be undermined. There is an abundance of cases in which community problems have been studied with great thoroughness but the stakeholders have not been involved in policy formulation (80). Stakeholders are not only able to define and identify problems but also contribute to finding workable solutions, adequate funding and techniques for implementation.

A plan might contain the community vision (see Section 5.4), including a consensus on problems and opportunities, strategic goals, targets, indicators, implementation strategies and the partners to be involved. As already stated, indicators can be used not only for gathering baseline information (against which to measure progress towards achieving goals and targets), but also for setting goals and targets based on identified problems. Additional ranking of goals and targets may be required in order to decide on the priorities to which resources should be directed first. A framework for evaluation should also be included.

Experience acquired in the development of national environment and health action plans has shown that indicators which are necessary for measuring performance in achieving goals and targets, have often not always been used or identified. Nevertheless, ways have been found of bringing various sectors and partners together (see Chapter 5) in order to develop a shared vision and understanding of what is needed, and a set of goals and measurable benchmarks or indicators which reflect community values, goals and aspirations.

Specific targets and indicators are usually developed after the goals have been set. Thus, for example, the target might be to achieve a certain percentage of children who are immunized against diseases such as measles or polio, or to increase by a certain amount per year the percentage of the population living in areas with air quality within international safety limits. Targets can be aspirational, reflecting popular will, or achievable, based on formal calculations of the size of the problem, the cost-

effectiveness of the solution and the availability of resources. Examples of targets in the renewed WHO Health for All policy (1, 83) are given in the box below. Regional targets have also been developed (84, 85).

Box 11

TARGETS OF THE HEALTH-FOR-ALL INITIATIVE

By 2005, health equity indices will be used within and between countries as a basis for promoting and monitoring equity in health. Initially, equity will be assessed on the basis of a measure of child growth.

By 2020, the targets agreed at world conferences for maternal mortality rates, under-five or child mortality rates and life expectancy will be attained.

By 2020, the worldwide burden of disease will be substantially decreased. This will be achieved by implementing sound disease control programmes aimed at reversing the current trends of increasing incidence and disability caused by tuberculosis, HIV/AIDS, malaria, tobacco-related diseases and trauma due to violence.

Measles will be eradicated by 2020, lymphatic filariasis will be eliminated by the year 2020, transmission of Chagas disease will be interrupted by 2010, leprosy will be eliminated by 2010 and trachoma will be eradicated by 2020. In addition, vitamin A and iodine deficiencies will be eliminated before 2020.

By 2020, all countries, through intersectoral action, will have made major progress in making safe drinking-water, adequate sanitation, food and shelter available in sufficient quantity and quality.

By 2020, all countries will have introduced and will be actively managing and monitoring strategies that strengthen health-enhancing lifestyles and weaken health-damaging ones, through a combination of regulatory, economic, educational, organizational and community-based programmes.

By 2005, all Member States will have operational mechanisms for developing, implementing and monitoring policies that are consistent with the Health for All policy.

By 2010, all people will have access throughout their lives to comprehensive, essential, quality health care, supported by essential public health functions.

By 2010, appropriate global and national health information, surveillance and alert systems will have been established.

By 2010, research policies and institutional mechanisms will be operational at the global, regional and country levels.

Source: WHO (1)

A MEGACITY'S APPROACH: TOKYO HEALTHY CITY PLAN

In its fundamental long-term plan, Tokyo's Metropolitan Government, serving a population of 12 million, recognized health promotion as an essential means of achieving a healthy society. The Tokyo Citizens' Council for Health Promotion was established in 1991 to make Tokyo a Healthy City by developing a health promotion movement in close cooperation with the public and private sectors, in order that every citizen of Tokyo could live a healthy, active life. Tripartite teams comprising citizens, administrators and academics developed cross-sectoral programmes and policies based on a scientific understanding of human health and the megacity environment. The action plan, entitled "Towards Healthy City Tokyo-Our Action Plan for Health Promotion", was first adopted by the Council in 1993. It defined priorities for action and the roles of citizens and the private and public sectors and also proposed some key strategies. It thus encouraged studies of health promotion as a strategy in the effective development of community-based plans and implementation of health promotion programmes.

Graphical representations of health and its determining indicators were used to evaluate public health and the urban environment. The action plan encouraged the use of mapping for both metropolitan and municipal governments and other sectors. By evaluating the effect of the urban environment on public health, this analysis helped people from various sectors to share information and also helped decision-makers to formulate a policy beneficial to public health. Symposia, fora, health fairs and other opportunities were used to disseminate information. Publications introduced examples of activities and programmes actually under way in Tokyo, and were widely used by various communities to improve the development of their own programmes.

Source: Nakamura & Takano (86)

6.4 IMPLEMENTATION, MONITORING, EVALUATION AND FEEDBACK

Failure to implement plans is a common problem and one of the biggest stumbling blocks to achieving the desired goals. The plan stands a better chance of success if the practical requirements of implementation are addressed: people often know what to do, but not how to do it. Plans should include commitments to the programme by all the stakeholders concerned and agreements to undertake the relevant work. This is part of an ongoing process and entails the responsibility of the stakeholders to involve residents, organizations and various sectors on a continuous basis. There is evidence to suggest that plans developed in this way promote collaboration between sectors and serve to generate awareness of health and environmental problems by government authorities, non-governmental agencies and communities. They may also be useful for mobilizing resources to deal with problems. The plan should not, however, be regarded as a "one-off" exercise that will generate all the actions needed to solve

all the problems once and for all, but should rather be seen as a process of consultation, data gathering and analysis and mobilization of resources for priority actions.

The next step is to monitor the implementation of the plan. Ideally, monitoring should begin before and should continue during and after implementation. Evaluation is important for maintaining accountability among the stakeholders, providing feedback to communities and supplying information to service users and providers. Systems are needed to allow the stakeholders to report to each other on progress, and methods and tools such as indicators are needed to measure the achievement of goals and targets. Two aspects of the use of indicators for reporting on performance should be evaluated: the partnership's ability to achieve the goals and targets of the plan and progress in actually improving health and environment conditions. The latter would require a comprehensive audit every few years (87).

THE CASE OF SANTA MONICA, USA

In Santa Monica, USA, a number of policy goals and related targets were established within the Sustainable City programme. Indicators were then developed to monitor the City's annual progress towards meeting each target (88). Examples of selected goals, targets and indicators are given below:

Policy Area: Resource conservation

- Goals:**
- Promote the use of conservation techniques and practices and reduce the use of non-renewable resources
 - Develop local, non-polluting, renewable energy, water and material resources and expand recycling techniques in these areas

- Targets:**
- Reduce energy consumption by 16%
 - Reduce potable water consumption by 20%
 - Reduce the solid waste volume by at least 50%
 - Convert 75% of the city vehicle fleet to reduced emission fuels
 - Reduce waste-water flows by 15%

Indicators:	1990	1993	2000
Energy consumption (non-mobile sources)	4.0 million Btu/year	4.0 million Btu/year	3.36 million Btu/year
Water consumption	14.3 million gallons/year	12.0 million gallons/year	11.4 million gallons/year
Waste-water flow	10.4 million gallons/day	8.5 million gallons/day	8.8 million gallons/day
City fleet vehicles using reduced emission fuels	Unknown	10%	75%

Source: International Council for Local Environmental Initiatives (88)

THE SUSTAINABLE SEATTLE PROJECT

The Sustainable Seattle Project (89), started in Seattle, USA, in 1990, has been recognized world-wide for its participatory and empowering approach. The project was organized by Sustainable Seattle, a volunteer network and civil forum comprising individuals from such bodies as the City Government, environment, religious and business groups and labour and community organizations. The primary objective of the project was to engage stakeholders in defining what constitutes a sustainable community and in providing measurements of sustainability that could be used to guide local decision-making. With a view to developing a long-term strategy to improve the health and vitality of the region, a group of 25 trustees drawn from community leaders was appointed, and they in turn appointed a task team to generate draft indicators. The approach thus combined public participation with research carried out by an indicator task team.

The indicators were specifically selected to measure the City's progress towards sustainability, to identify key problems and priorities and to help understand the changes needed to ensure community well-being over time. Through a process of extensive consultation and review with the general public, community leaders, the business sector, government and academic and non-profit organizations, an initial list of 150 indicators was used to develop a final selection of 40 indicators grouped into five key areas.

The indicator data were drawn from a wide range of sources and sectors, including local hospitals, the departments of transport, health, housing, agriculture, solid waste, planning, waste water and power utilities, the air pollution control agency, schools and special surveys.

Indicators used in the Sustainable Seattle Project included the following:

- | | |
|---------------------------------|--|
| Environment | <ul style="list-style-type: none">• Counts of wild salmon in local rivers and streams• The number of "good" air quality days in the calendar year• Population size• Soil erosion (turbidity levels at selected sites) |
| Population and resources | <ul style="list-style-type: none">• Per capita water consumption• Solid waste generated and recycled• Number of people in King County |
| Economy | <ul style="list-style-type: none">• Distribution of personal income |
| Youth and education | <ul style="list-style-type: none">• Adult literacy |
| Health and community | <ul style="list-style-type: none">• Proportion of low-birth-weight babies• Rate of hospitalization of children for asthma• Proportion of people who are satisfied with their quality of life |

(cont'd)

Evaluation and action

During the first few years of the project, data on 14 of the 40 indicators showed a need for action with regard to the environment, development and health in Seattle, and action plans on the issues highlighted were developed and implemented.

The indicators nevertheless failed to meet all of the objectives, as they were unrelated to the general planning process (87). The City subsequently set up a separate task force to develop a municipal strategic plan with long-term goals for Seattle, as well as a performance management system for which special indicators were developed on the basis of the nearly 500 goals and policies in the City plan. The core indicators were based on the following criteria:

- a direct and understandable relationship to one or more of the plan's goals or policies or to its vision
- the availability of reliable and regular information in order to track the indicator in a cost-effective manner
- relationship of the list of selected indicators to progress towards the core values underlying the plan.

Source: Brugmann (87), International Council for Local Environmental Initiatives (90)

INDICATORS FOR SUSTAINABLE DEVELOPMENT IN THE UNITED KINGDOM

A consultation document entitled Opportunities for Change, issued in 1998, set out the Government's vision of sustainable development and what needed to be done to put it into practice. In May 1999, the Government published the document "A Better Quality of Life: A Strategy for Sustainable Development in the United Kingdom". The strategy outlined four main aims:

- social progress that recognizes the needs of everyone
- effective protection of the environment
- prudent use of natural resources
- maintenance of high and stable levels of economic growth and employment.

To help measure progress, the strategy included a series of 150 indicators, (25), which will be at the core of future reports on progress. A subset of 14 «headline» indicators was selected to focus public attention on what sustainable development means and to give a broad overview of progress in achieving a better quality of life for everyone, including future generations.

The national set of core indicators was intended:

- to describe overall whether sustainable development at the national level is being achieved

(cont'd)

- to highlight national policy initiatives relevant to sustainable development and to monitor whether the targets and commitments are being achieved in those areas
- to educate the public about what sustainable development means
- to raise the awareness of the public and businesses of the actions they must take to achieve sustainable development
- to report progress to international audiences
- to make the trade-offs and synergies between sustainable development objectives transparent.

In addition to technical criteria, indicators were included in the national core set if:

- the indicator was an overriding “state of nation” indicator describing a key objective
- it reflected a key international or national commitment or target
- it supported a key message for individuals or business especially in relation to key actions needed, for example energy efficiency, health and safety at work and ethical trading
- it was recommended for use in national reporting.

A sample of sustainable development indicators with the key objectives to which they relate are given below.

Table 14

**THE HEADLINE INDICATORS IN THE UNITED KINGDOM
SUSTAINABLE DEVELOPMENT STRATEGY**

Themes, issues and objectives (strategy reference)	Headline Indicators
<p>Maintaining high and stable levels of economic growth and employment:</p> <ul style="list-style-type: none"> • Our economy must continue to grow • Investment (in modern plant and machinery as well as research and development) is vital to our future prosperity • Maintain high and stable levels of employment so everyone can share greater job opportunities 	<ul style="list-style-type: none"> • Total output of the economy (GDP and GDP per head) • Total and social investment as a percentage of GDP • Proportion of people of working age who are in work
<p>Social progress which recognizes the needs of every one</p> <ul style="list-style-type: none"> • Equip people with the skills to fulfil their potential • Improve the health of the population overall • Reduce the proportion of unfit (housing) stock • Reduce both crime and fear of crime 	<ul style="list-style-type: none"> • Qualifications at age 19 • Expected years of healthy life • Homes judged unfit to live in • Level of crime

Themes, issues and objectives (strategy reference)	Headline Indicators
<p>Effective protection of the environment</p> <ul style="list-style-type: none"> • Continue to reduce our emissions of greenhouse gases now, and plan for greater reductions in longer term • Reduce air pollution and ensure air quality continues to improve through the longer term • Improve choice in transport; improve access to education, jobs, leisure and services; and reduce the need to travel • Improving river quality • Reverse the long-term decline in populations of farmland and woodland birds • Re-using previously developed land, in order to protect the countryside and encourage urban regeneration 	<ul style="list-style-type: none"> • Emissions of greenhouse gases • Days when air pollution is moderate or higher • Road traffic • Rivers of good or fair quality • Populations of wild birds • New homes built on previously developed land
<p>Prudent use of natural resources</p> <ul style="list-style-type: none"> • Moving away from disposal of waste towards minimization, reuse, recycling and recovery 	<ul style="list-style-type: none"> • Waste arisings and management

Source: U.K. Department of Environment, Transport and Regions (25, 91)

INDICATORS OF SUSTAINABLE DEVELOPMENT IN FINLAND

Work on sustainable development indicators in Finland began in 1996, with the commitment to test indicators developed by the United Nations Commission on Sustainable Development. The testing phase took one year. In 1998, Finland developed a national set of sustainable development indicators to meet the needs identified in the Government Programme for Sustainable Development during 1998. This set was developed during 1998-1999. The programme was developed under the auspices of the Finnish Ministry of the Environment, supported by the Finnish Commission on Sustainable Development and research conducted by the Finnish Environment Institute. The overall work programme was supported by a task force called Indicator Net, consisting of individuals from several key ministries and institutes.

The Government's programme is designed to promote ecological sustainability, and the economic and social preconditions for achieving it.

With the aim of establishing the social and cultural preconditions for ecological sustainability, the Finnish Government will:

(cont'd)

- Strengthen the joint learning and innovative processes of different social actors, thereby augmenting Finland's capacity for meeting the challenge of sustainable development
- Promote public initiative and participation and the opportunity for the public to influence issues and support local projects for sustainable development
- Promote general welfare, with special attention to employment, prevention of social exclusion and the living conditions of the elderly
- Strengthen the knowledge base, expertise and skills needed for sustainability
- Improve the health, amenity and social viability of occupational, residential and living environments and advance the health and physical fitness of the general population
- Safeguard cultural diversity, cultural heritage and cultural identity.

The choice of indicators for national use started with the identification of important issues and themes. The issues chosen were more problem-oriented than sectoral. They were discussed with experts and non-governmental organizations in special workshops. The criteria developed to select indicators placed emphasis on factors such as reliability and "user-friendliness", i.e. whether the indicator was required by the user, if it was simple and easy to interpret, responsive to changes, allowed forecasting, whether a target or a recommendation was available, whether it allowed comparison, or whether data were available at reasonable costs. A list of some 85 national sustainable development indicators was developed, a sample of which is given below.

Table 15

PROPOSED SUSTAINABLE DEVELOPMENT INDICATORS

ECOLOGICAL ISSUES	INDICATORS
Climate change	<ul style="list-style-type: none"> • Greenhouse gas emissions • Summer and winter mean temperatures in Finland • Icebreaking date of Tornio River
Ozone layer depletion	<ul style="list-style-type: none"> • Import of ozone depleting substances (same as use of ODS) • Stratospheric ozone above Finland
Acidification	<ul style="list-style-type: none"> • Emissions of acidifying substances • Critical loads of sulphur
Eutrophication	<ul style="list-style-type: none"> • Discharges of nutrients to waters • Nutrient balance in agriculture • Algal concentration in coastal waters • Quality of lakes and rivers
Biodiversity	<ul style="list-style-type: none"> • Threatened species • Number of seals in the Baltic Sea • Decline of bird populations in forestry and agricultural areas • Protected areas • Implementation of nature conservation programme

ECOLOGICAL ISSUES	INDICATORS
Toxic contamination	<ul style="list-style-type: none"> • VOC emissions to air • Mercury emissions • Pesticide use • PCBs in Baltic Herring in the Baltic Sea • Dioxins in breast milk
ECONOMIC ISSUES	INDICATORS
Economic development	<ul style="list-style-type: none"> • Gross domestic product • Current account • Government debt inflation
Administrative and economic instruments	<ul style="list-style-type: none"> • Percentage of environmental taxes and payments in total tax income • Industrial expenditure on environmental protection • Tax rate of fuels in relation to coal content • EMAS-registered enterprises and environmental certificates
Natural resources	<ul style="list-style-type: none"> • Age structure of forests • Annual increment and total drain of forest resources • Area of cultivated land and fallow • Number of reindeer • Commercial fisheries • Fish production • Proven mineral reserves
Urban structure and transport	<ul style="list-style-type: none"> • Growth of urban population and urban areas • Population density in urban areas • Average distance travelled to work • Number of cars and their output • Use of public transport and private cars • Air quality in cities
Production and consumption	<ul style="list-style-type: none"> • Consumption of energy • End use of energy • Total use of natural resources • Consumption of water • Air traffic • Household consumption • Accumulation of waste • Waste deposited in landfill • Recovery of packaging materials
SOCIO-CULTURAL ISSUES	INDICATORS
Factors affecting population	<ul style="list-style-type: none"> • Population change • Dependency ratio • Life expectancy • Net migration in rural areas

SOCIO-CULTURAL ISSUES	INDICATORS
Health	<ul style="list-style-type: none"> • Number of people who smoke daily • Proportion of overweight people • Diseases caused by alcohol and drugs • Reported HIV cases • Suicides
Employment	<ul style="list-style-type: none"> • Unemployment rate • Work-related illnesses • Long-term unemployed as a percentage of all unemployed • Retirement age
Social problems and equality	<ul style="list-style-type: none"> • Head Count Index • Income differentials • Homeless people • Proportion of women's salary of men's salary • Children and young persons placed outside their own homes • Violent crimes
Education, research and participation	<ul style="list-style-type: none"> • Level of education • Qualifications achieved • Research and development expenditures • Young people left outside education and working life • Voting in parliamentary elections
Access to information	<ul style="list-style-type: none"> • Public libraries, loans per inhabitant • Circulation of newspapers • Weekly users of the Internet
Cultural heritage	<ul style="list-style-type: none"> • Visitors to museums • Age structure of buildings • Natural meadows and pastures
Ethnic minorities	<ul style="list-style-type: none"> • Sami students who receive teaching in their mother tongue • Unemployment rate of immigrants
Development cooperation	<ul style="list-style-type: none"> • Official development aid • Development aid to regions near Finland

Source: Finnish Environment Institute (92)

From the previous discussion it is evident that examples may be found throughout the world of the use of indicators to inform the development of policy and plans and to evaluate their implementation. Nevertheless, it is also true that analysis of the effectiveness of the indicators developed and used today is at an early stage. It is

anticipated that much valuable information will be made available in the next few years from which lessons may be learnt. In reality, it is often the case that insufficient resources are allocated to the development of indicators and data collection, indicators are frequently developed independently of broader policy-making and planning, and problems continue to be experienced in basic data collection in many countries.

7

FRAMEWORK FOR LINKAGES BETWEEN HEALTH, ENVIRONMENT AND DEVELOPMENT

In this chapter, a framework for considering linkages between health, environment and development issues is given. The framework is particularly useful for describing pollution-related health impacts, but can be applied in other contexts as well. Indicators at various levels in the framework could be selected for use at the global, national and local levels, in relation to particular problems, issues or policies and plans in countries.

7.1 DEVELOPMENT OF FRAMEWORKS

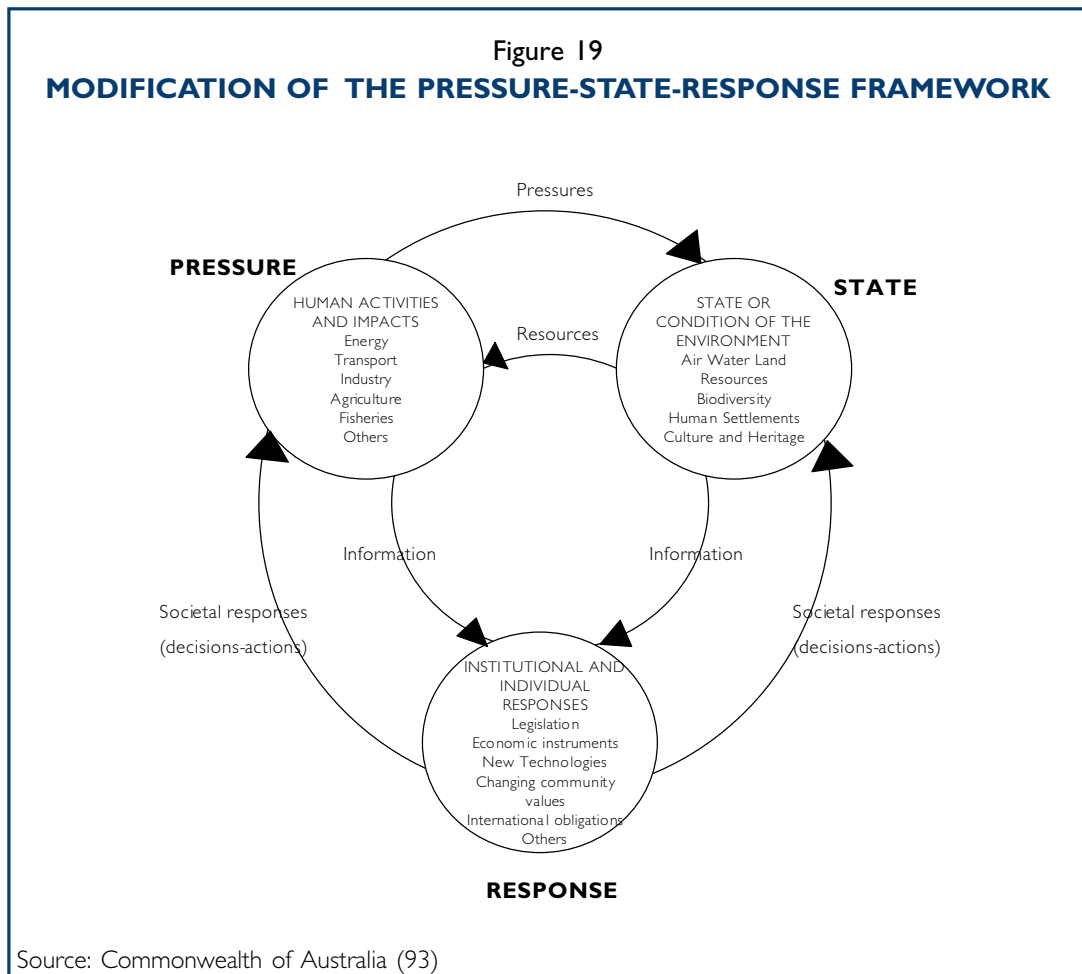
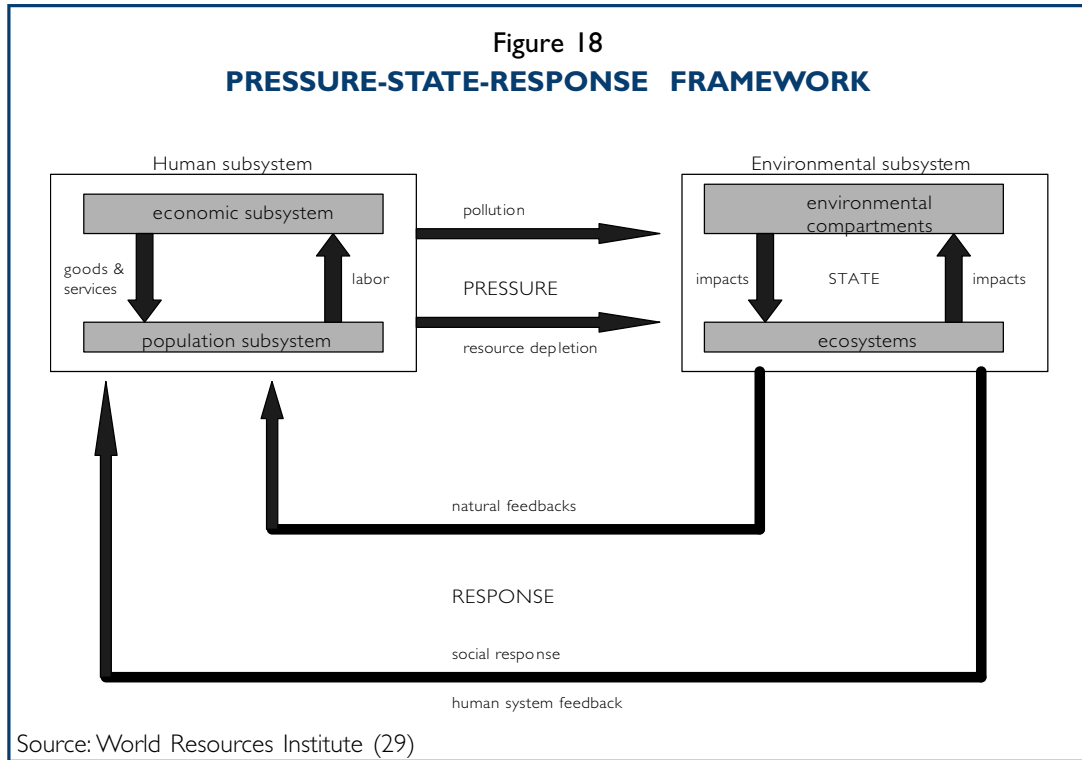
Decision-makers need not only better data on the linkages between the complexity of factors in the environment and development process affecting human health, but also enhanced understanding of such linkages. In terms of sustainable development, a framework is needed in which the various environmental, economic and social factors and components can be considered in a balanced way. A framework for presenting the linkages among factors that affect health in the context of environment and development has been adapted from the “pressure-state-response” (P-S-R) model developed by OECD, which in turn was based on earlier work by the Canadian Government.

The pressure-state-response (P-S-R) framework has been particularly useful in representing the way in which pollution affects the environment, for example by looking at the various “pressures” exerted on the environment which affect its “state” (quality) and consequently call for a “response” to deal with the situation. While this framework has been criticized as being linear and uni-directional, an adaptation of the framework by the Commonwealth of Australia (93), indicating the feedback loops in circular fashion, has proven useful.

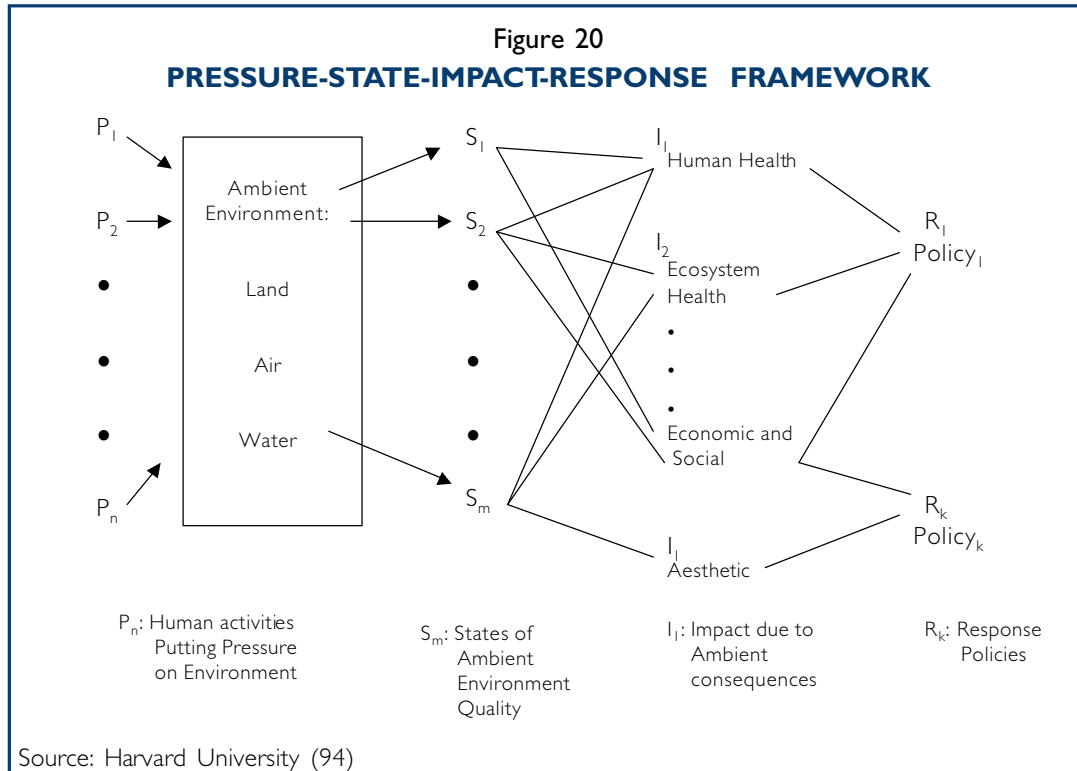
Other adaptations to the P-S-R framework have provided for the broader driving forces and their impacts, resulting in the “pressure-state-impact-response” (P-S-I-R) framework, which takes into account human health, ecosystem and social-economic impacts (94).

D-P-S-S-E-A Framework

In the context of human health impacts, both exposures and the resulting health effects must be represented. These aspects are taken into account in a further adaptation of

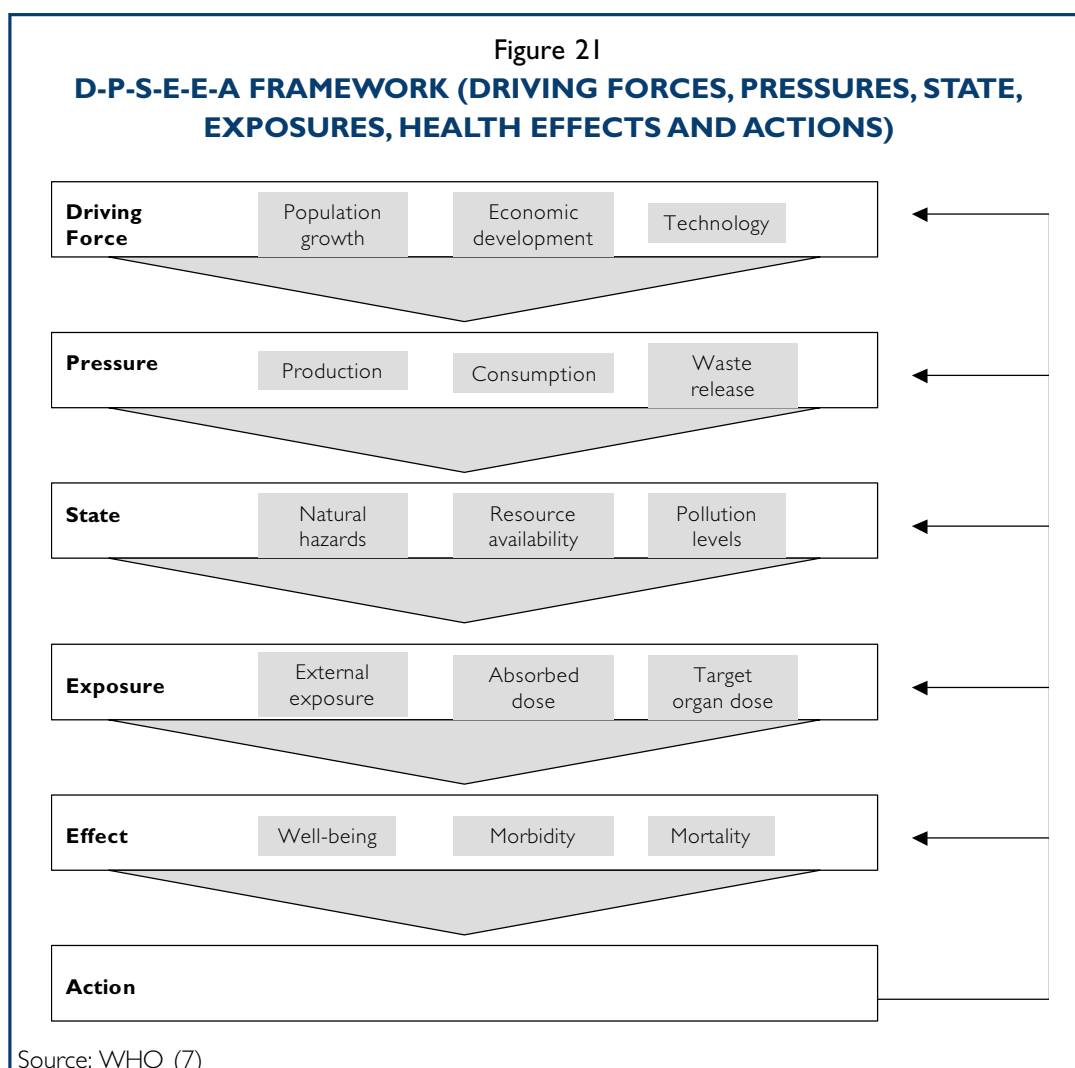


the framework for health purposes, referred to as the D-P-S-S-E-A framework (driving forces, pressures, state, exposures, health effects and actions), (22). This is a descriptive representation of the way in which various driving forces generate pressures that affect the state of the environment and ultimately human health, through the various exposure pathways by which people come into contact with the environment.



The D-P-S-E-E-A framework, like the P-S-R framework on which it is based, represents the components in a linear fashion in order to represent the connections between factors affecting health and the environment more clearly. In reality, the situation is more complex however, as various interactions occur at different levels between various components. The different components of the D-P-S-E-E-A framework are given in the figure below.

The framework takes account of the fact that, as already mentioned in Chapter 1, various factors responsible for health and environment problems may be associated with such driving forces as population growth, economic development, technological change and to the policies underlying them. Pressures may be exerted on the environment which cause development sectors to generate various types of outputs (for example in the form of pollutant emissions), causing the “state” (quality) of the environment to be degraded through the dispersal and accumulation of pollutants in various environmental media, such as air, soil, water and food. People may become “exposed” to potential hazards in the environment when they come into direct contact with these media, through breathing, drinking or eating. A variety of health effects may subsequently occur, ranging from minor, subclinical effects (i.e. effects that have



not yet manifested in overt symptoms) to illness and death, depending on the intrinsic harmfulness of the pollutant, the severity and intensity of exposure and the susceptibility of the individuals exposed. The elderly, the young and the sick may often be more susceptible than other groups.

Various actions can be implemented at different points of the framework and may take a variety of forms, including policy development, standard setting, technical control measures, health education or treatment of people with diseases.

The following sections give lists of indicators that could be used at various levels of the organizing framework, and which can be applied to information gathering and indicator development at the national or sectoral level, at the community or neighbourhood level or even at the level of an industrial enterprise (23). The framework is not rigid, and its applicability and usefulness will depend on the context in which it is used.

In many cases, consideration is given to more than one type of indicator for a similar issue, in order to illustrate the range of possibilities. The lists are not exhaustive but are meant to serve as a guide and stimulus for the selection of indicators that may be

appropriate for use in particular situations. Specific measurement variables and units of measurement will have to be further specified in almost all cases (see Chapter 4). Here, the indicators are given in “shorthand” in order to highlight issues. When appropriate and relevant, indicators should be disaggregated by sex, in order to address the gender dimension, and by other variables indicative of inequalities.

7.2 DRIVING FORCES

As already noted, a number of key factors on the macro scale broadly affect the environmental processes that may ultimately affect human health. For example, macroeconomic policies may have major effects on the environment and on people’s health. Trade and fiscal policies may indirectly impact on human health by affecting income levels and distribution, and agricultural or energy policy may affect health by impacting on land, air and water resources (95). It is often at this level of decision-making, i.e. higher up in the framework, that indicators are useful for setting and evaluating policies, as they allow examination of the root causes of problems, even if these are seemingly remote from the issue under consideration. Thus, if the aim is to take effective action at source, indicators that allow tracing of health effects to their underlying cause can be useful and can give an “early warning” of pending environmental problems. Waiting for actual health effects to occur may delay action, sometimes for years.

Another reason for using indicators at this level is that a certain amount of information is often available, whereas the necessary information becomes progressively more difficult to acquire as one moves down the framework. Information is usually more readily available on social and economic trends than, for example, on environmental conditions and health effects, but the links between environmental hazards and health effects become weaker and less direct as one moves higher up the framework.

Examples of indicators associated with driving forces which might be of use at this level of the development-environment-health framework are given below.

Box 12

EXAMPLES OF “DRIVING FORCE” INDICATORS

- Total fertility rate
- Population growth rate
- Urban growth rate
- Annual energy consumption levels
- GDP per capita and growth rate
- Income levels, distribution/trends
- Adult literacy rate
- Primary and secondary school enrolment rates
- Employment rate

(cont'd)

- Population below poverty line
- Social equity index

7.3 PRESSURES

The various driving forces considered above may result in pressures on the environment. Many factors however, including policy context, social attitudes and economic infrastructure, affect the extent to which driving forces are translated into actual pressures on the environment. Pressures are generated by all sectors of economic activity, such as transport, energy, housing, agriculture, industry, tourism and so forth. Pressures can occur from resource extraction, processing of materials and the production, distribution, consumption and release of waste products. An important pressure from the point of view of human health is the release of pollutants into the environment. Many different sources and media such as water, air and soil may be involved.

As discussed above, health and environment indicators at this level of the framework are important for addressing the root causes of problems, such as the release of pollutants or wastes or certain infrastructural developments which may manifest themselves only much later as effects on the state of the environment. Nevertheless, constraints similar to those discussed above with respect to driving forces also operate at this level: for example, the ability of the environment to absorb the various stresses imposed on it influences the extent to which changes in the state of the environment result.

Box 13

EXAMPLES OF INDICATORS ASSOCIATED WITH VARIOUS PRESSURES

“Pressure” indicators: Air

- Number and type of polluting industries
- Levels of domestic consumption of gas, coal and biomass
- Production and consumption of ozone-depleting substances such as chlorofluorocarbons (CFCs)
- Consumption levels of leaded gasoline
- Average road traffic volume and density
- Annual emissions of:
 - sulfur and nitrogen oxides
 - particulates, toxics and heavy metals
 - carbon monoxide and volatile organic compounds (VOCs)
- Annual national and global emissions of greenhouse gases (for example carbon dioxide) by source
- Annual emissions from major industrial facilities by source

(cont'd)

- Annual emissions from mobile sources, for example transport
- Annual emissions of radionuclides from nuclear facilities
- Emissions of chlorinated dioxins, furans, mercury and other harmful pollutants from waste-burning facilities
- Accidental releases of toxic chemicals and radioactive substances

“Pressure” Indicators: Water

- Availability of water resources per capita
- Water consumption by use per capita
- Domestic consumption of water per capita
- Water recirculation levels in industry
- Amount of fresh water and coastal waste water discharges
- Amount of industrial/municipal effluent (treated and untreated) discharged
- Tonnes of sewage discharged into water bodies
- Discharges of domestic and industrial waste-water into surface water

“Pressure” Indicators: Waste

- Annual tonnage of hazardous and medical waste produced, by class
- Imports and exports of hazardous waste (tonnes/year)
- Toxic constituents of hazardous waste produced
- Amount of radioactive materials used
- Amount of municipal, agricultural, industrial and nuclear waste generated
- Annual amount of domestic waste produced/disposed of per household/per person
- Quantities of toxic chemicals in waste streams released, disposed of, treated or combusted for recovery
- Amount of untreated waste produced
- Amount of stored radioactive waste, by class
- Amount of radioactive waste not meeting waste disposal standards
- Amount of waste not collected, illegally dumped
- Proportion of hazardous wastes disposed to open dumps
- Proportion of sewage treated to secondary level
- Amount of waste re-used
- Percentage of domestic waste collected for recycling
- Frequency of waste collection in residential areas.

7.4 STATE

The state (quality) of the environment may be affected by the various pressures exerted. Some changes may be complex and widespread, affecting almost all aspects of the environment and resulting in effects such as desertification, marine pollution or climate change, while others may be more localized (for example, contamination of a local water supply). The frequency or magnitude of natural hazards may be increased (for example floods, soil erosion), natural resources may be negatively affected (for example biodiversity, soil fertility) or the quality of air and water may be affected by

pollution. Secondary effects may also occur, since modifications in one area may affect others. New health hazards may be generated at each step.

Box 14

**EXAMPLES OF INDICATORS OF
THE STATE OF THE ENVIRONMENT**

“State” Indicators: Air

- Pollutant concentrations (for example sulfur dioxide, nitrogen oxides, ozone, particulates, lead) in urban air
- Concentrations of carbon monoxide and volatile organic compounds in urban air
- Number of hours/days per year during which pollutants exceed standards
- Total suspended particulates, PM₁₀/PM_{2.5}/black smoke exceedance of guidelines or standards
- Concentrations of ozone-depleting substances in air
- Global atmospheric concentration levels of greenhouse gases
- Indoor air pollution levels
- Annual number of severe pollution incidents

“State” indicators: Water

- Exceedance of standards and guidelines for:
 - drinking-water
 - recreational fresh and marine waters
 - aquaculture water
 - irrigation water
- Proportion of inland surface waters not meeting standards for the preparation of drinking-water
- Proportion of recreational surface waters not meeting bathing-water quality standards
- Faecal coliform levels in fresh water
- Percentage of rivers, streams, lakes and reservoirs providing water that is not safe for use without treatment
- Concentrations of nitrogen and sulfur oxides in precipitation
- Water hardness, colour, taste, pH, biological oxygen demand, chemical oxygen demand, optical density, total organic compounds, volatile organic compounds
- Concentrations of nitrates, nitrites, phosphates in drinking-water
- Levels of pesticide residues in drinking-water

“State” indicators: Other media

- Levels of radiation/radionuclides in environmental media
- Levels of lead, cadmium, arsenic, mercury in air; drinking-water; soil, dust, food
- Concentrations of polychlorinated biphenyls, dioxins in food, air, water
- Frequency of illegal pesticide residues in food and water
- Levels of faecal coliforms and *Escherichia coli* in food, water
- Area of land/number of sites contaminated by hazardous waste
- Community and occupational noise levels exceeding standards

7.5 EXPOSURES

Even where the state of the environment is unduly affected, people's health and well-being may be affected only when they are actually exposed. Many factors determine whether an individual will be exposed, for example, to pollution in the environment. Pollution levels vary from place to place and over time, and people's activities and behavioural patterns may influence the extent to which they come into contact with the environment. An environmental factor may play a major or a minor role in influencing a disease outcome. With low levels of exposure, the factors concerned may more often play a contributory rather than a primary role in causing disease.

Since many diseases are caused by a number of factors, it may be difficult to determine the effects of one exposure among others. Moreover, human beings are often exposed to mixtures of chemicals that are not well characterized. The effects of exposure to two or more chemicals or to a chemical and other harmful agents are not well understood.

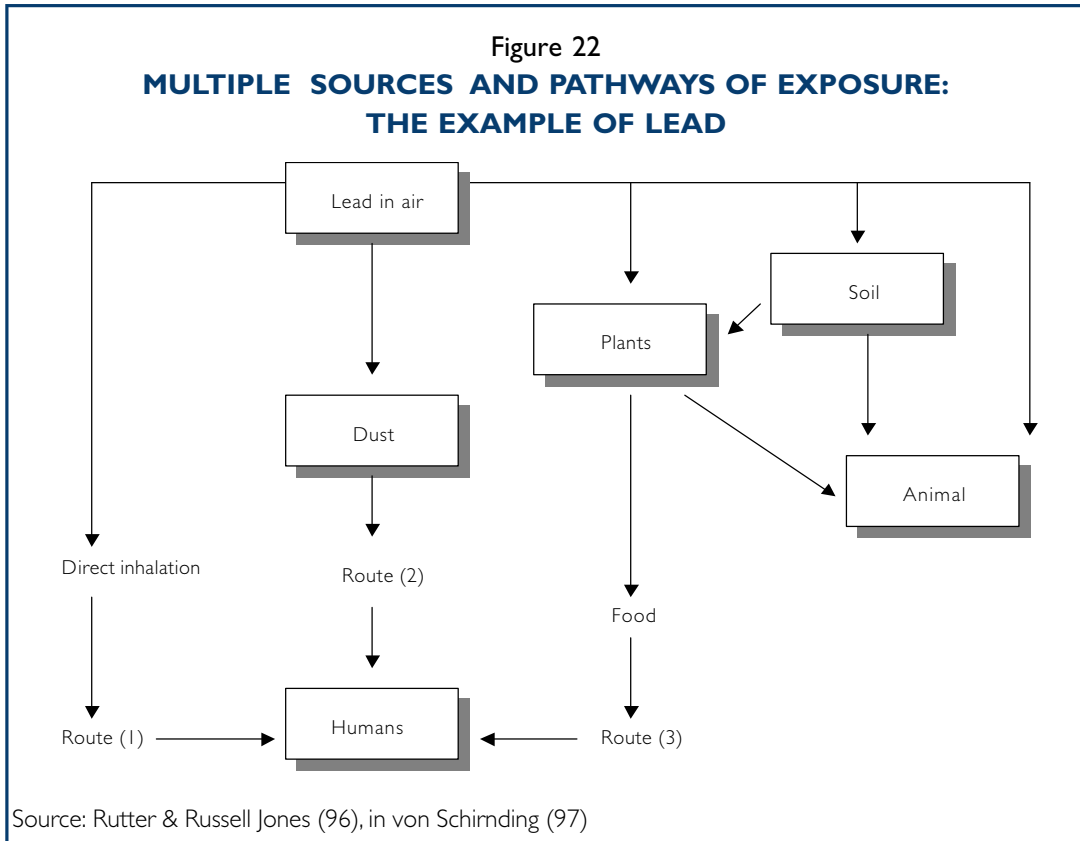
The co-action of other factors may be required for significant effects to occur. In some cases, multiple exposures may result in a synergistic effect (where the combined effect is greater than the sum of the individual effects). Combined effects may often arise with nutritional and other lifestyle factors such as smoking and alcohol intake. Thus, for example, the incidence of lung cancer is higher in uranium miners and asbestos workers who are smokers than in workers with similar occupational exposures who are not smokers.

Exposure to chemicals is usually mediated by complex environmental pathways, and more than one route may contribute to uptake. People may be exposed through the air they breathe, the water and food they ingest or contact with the skin.

Exposure should be characterized and measured, indirectly as the concentration of the pollutant in the environment (taking the duration of exposure, peoples' activity patterns into account), as an estimate of the amount that an individual actually ingests, inhales or absorbs, or as the amount that actually reaches a target organ where a health effect may occur.

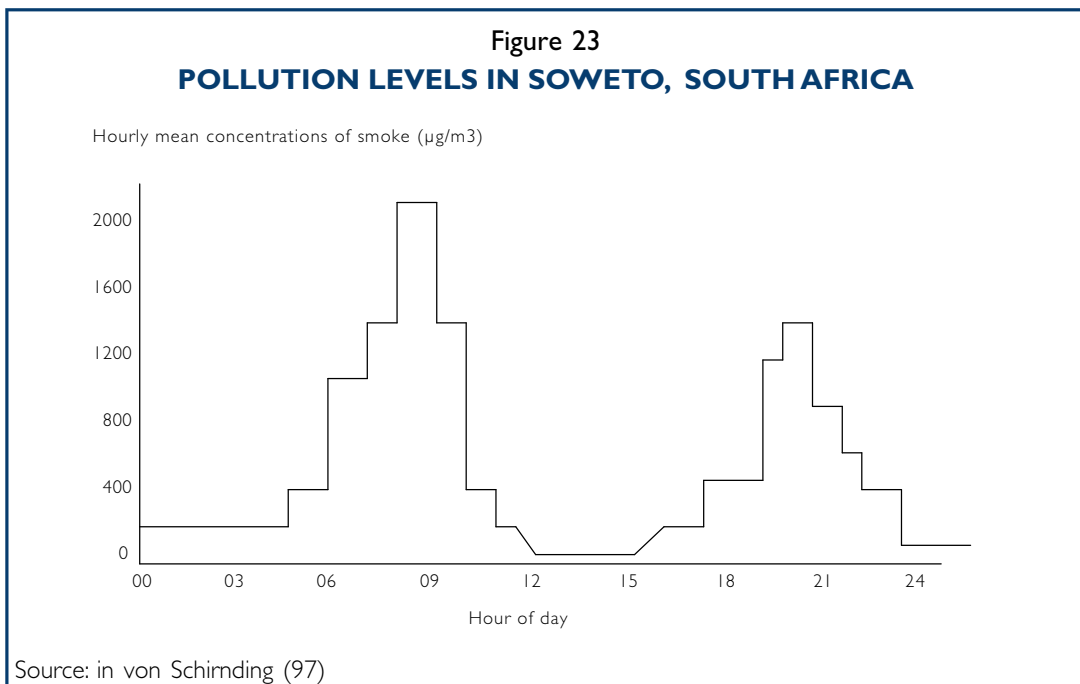
While exposure in the occupational setting may be easier to characterize than exposure in the environmental setting, in both contexts it is often necessary to rely on proxies of exposures. These include such state of environment indicators as the concentration of pollution or pressure indicators even further removed from the exposure in question, such as emission rates, estimates of traffic volume, distance from a source such as a road or industry, or living in a home with smokers.

The concentrations of pollutants in the environment are often measured in order to detect peak levels, in assessing compliance with standards or guidelines. Monitoring may be carried out at places of little relevance to typical human exposures however, and in many cases only a few areas and substances are monitored. Knowledge of temporal and spatial variations in concentrations of substances are needed. For many pollutants, the concentration decreases sharply with distance from the source, and vertical and temporal variations may be found (98).



Improved biological and biochemical markers of exposure should enhance the effectiveness of exposure assessments in the future.

Whatever technique is chosen to characterize exposure, account must be taken of the exposure of groups at specific risk, which include the poor, women, children and workers.



Box 15

EXAMPLES OF DIRECT AND INDIRECT INDICATORS OF EXPOSURES

“Exposure” indicators: Air

- Proportion of population living in proximity of sources of air pollution (traffic, industrial activities)
- Proportion of population with elevated personal exposures to air pollutants such as particulate matter with a diameter of less than 10 micrometres
- Proportion of population exposed to elevated levels of pollutants in microenvironments, and estimates of time spent in different microenvironments
- Proportion of population exposed to air quality in excess of standards
- Proportion of population exposed to high levels of radon or of dust lead levels in their homes
- Proportion of population exposed to indoor pollution from burning coal or biomass
- Proportion of children exposed to high levels of environmental tobacco smoke
- Proportion of population who smoke (children, adolescents and adults)
- Carboxyhaemoglobin concentrations in blood
- Proportion of population with raised blood lead levels

“Exposure” indicators: Water

- Proportion of population whose homes are not connected to a water supply system (urban versus rural)
- Proportion of population served by drinking-water systems without source water protection
- Proportion of population without access to safe drinking-water
- Proportion of population whose drinking-water supplies do not meet health standards
- Proportion of population not receiving safe water in the home (or within 15 minutes' walking distance of the home)
- Proportion of population with no safe drinking-water within reasonable walking distance

“Exposure” indicators: General

- Proportion of population living in poor housing conditions
- Proportion of population homeless
- Proportion of population living in substandard housing
- Proportion of dwellings disconnected from water, electricity, gas supplies
- Average number of persons per room in occupied housing units, distribution according to density
- Proportion of population without access to a sewerage system, septic tank or other hygienic means of sewage disposal
- Proportion of population with inadequate sanitation facilities in the home or immediate vicinity
- Proportion of population with inadequate excreta disposal facilities
- Proportion of population with raised blood lead levels

(cont'd)

- Proportion of population exposed to persistent organic compounds, for example aldrin, dieldrin, chlordane, DDT, endrin, heptachlor, hexachlorobenzene, polychlorinated biphenyls, dioxins, furans
- Proportion of workers exposed to hazardous working conditions, by class type
- Proportion of workers exposed to unsafe levels of dusts, fumes or gases in the work place
- Proportion of workers exposed to noise levels above safety standards

7.6 HEALTH EFFECTS

Once a person has been exposed to an environmental hazard, health effects may manifest themselves which may vary in type, intensity and magnitude depending on the type of hazard, the level of exposure and other factors. The ill-health effects of environmental exposures may be acute, occurring relatively soon after exposure (from a single large dose due to an accident or a spill for example), or they may be chronic, occurring as a result of cumulative exposures over time. A long time may elapse between the initial exposure and the appearance of the adverse health effect, for example exposure to asbestos and mesothelioma, or exposure to radiation and leukaemia. Dispersal of the population at risk over time and the long incubation period make reconstruction of exposures problematic, so that acute health effects are often easier to detect than chronic ones, which may be difficult to relate to specific hazards or sources.

While almost any substance can cause harm if taken into the body in sufficiently large amounts, the substances of frequent concern are those which may have adverse health effects even at relatively small doses. A hierarchy of effects may occur, ranging from minor, temporary ailments to acute illness or chronic disease, with relatively resistant and susceptible persons at either extreme of the distribution. Infants and young children may be at high risk, as they take in more of a contaminant in relation to their body size than do adults and have immature and therefore particularly vulnerable physiologies. The unborn fetus is especially susceptible to toxic chemicals. Elderly people are also vulnerable from a physiological point of view, and may be more susceptible to lung infections than young people. The vulnerability of individuals (as opposed to groups) may also vary over a wide range.

Thus generally speaking, many factors affect the extent to which a hazard in the environment affects human health. The form, duration, intensity and timing of exposure are important, as is the health status, age and genetic make-up of the individual, as well as the quality and accessibility of the health care system.

Health Risk Assessment

In assessing health risks from environmental exposures, reliance is placed on

epidemiology and toxicology. Environmental epidemiology is concerned with health effects in populations which result from exposures to environmental factors under conditions of “daily living” (99), while toxicology involves studies of the effects of potentially toxic substances on human beings or animals under controlled conditions. Such studies are needed to identify the toxicity of substances in advance, but it is often necessary to extrapolate from studies on laboratory animals at high doses to low doses and then to human populations. Many assumptions are involved. Results obtained in animals are not necessarily applicable to human beings, and it is usually not possible to reproduce all the potential contributing factors in the laboratory.

Although general indicators of ill-health may not be very useful, certain diseases may indicate environmental problems. “Sentinel” diseases or conditions which are rare can often be more readily related to an external factor. Examples include mesothelioma as an indicator of exposure to asbestos, silicosis as an indicator of exposure to silica dust and lung cancer as an indicator of exposure to tobacco smoke.

Examples of health indicators that might suggest environment-related disease are given below. Sometimes, health indicators might be developed for specific groups at risk, such as women and children, the elderly, the disabled or the poor. The significance of any individual indicator depends on the exposure concerned and the context of the issue or problem being addressed. In describing any one health issue or problem, sets of indicators would normally be compiled from those listed at various levels of the framework.

Box 16

EXAMPLES OF HEALTH EFFECT INDICATORS

Environment-related (or suspected)

- Number of outbreaks of foodborne disease (for example Salmonella, E. coli, listeria) and waterborne disease (for example cholera, typhoid, giardia, shigella)
- Work-related mortality and morbidity (for example in respect of asbestosis, mesothelioma, silicosis, heavy metal poisonings, fatal and non-fatal injuries)
- Mortality and morbidity associated with motor vehicle accidents
- Number of deaths from drowning
- Mortality and morbidity associated with non-work-related injuries and poisonings (for example pesticides)
- Environment-related cancer morbidity and mortality (for example lung cancer in non-smokers)
- Morbidity and mortality associated with typhoid, malaria, polio, cholera, hepatitis A and other infectious/parasitic diseases
- Morbidity and mortality associated with diarrhoea in young children
- Morbidity and mortality associated with acute respiratory infections/pneumonia in young children
- Morbidity and mortality associated with asthma
- Mortality and morbidity associated with chronic respiratory disease

(cont'd)

- Mortality and morbidity associated with:
 - Allergic diseases, hypersensitivity disorders
 - Dermatitis, dermatoses
 - Birth defects
 - Reproductive function effects
 - Leukaemia in children
 - Malignant melanomas
 - Developmental defects
 - Neurological deficits, neurotoxicity
 - Mental disorders

General mortality

- Crude death rate
- Infant mortality rate
- Neonatal mortality rate
- Perinatal mortality rate
- Post-neonatal mortality rate
- Life expectancy

7.7 ACTIONS

An approach to the control and prevention of health hazards which focuses on hazards of human origin is useful in that it addresses potentially remediable problems. This approach however must be adopted with due regard for the still considerable uncertainty that exists about the extent of the direct and indirect risks to human health associated with specific agents in the environment or with the broader development process.

While in some instances the hazards in question are known and identified, the contrary is often the case. For many substances, it is not known whether there is a threshold for an adverse effect and, if so, what that threshold is. Much environment-related disease goes unrecognized. Certain cancers and “subtle” diseases and disorders such as intelligence impairment caused by exposure to lead during childhood may not be recognized as being due to environmental factors.

While sound public policy is based on analyses of the best available information, it does not require absolute scientific certainty. Different actions can be taken, targeted at various points in the framework. It would obviously be impossible to reduce all environmental exposures to a level at which the risk to human health is zero. Measures to improve public health must be implemented over time. Such measures may be short-term and remedial or longer-term and preventive (for example changing personal behaviour and life styles). Measures could take the form of a policy or comprehensive plan of action (see preceding chapters on the planning process), which outlines the goals to be achieved in improving health and the environment and mechanisms for

attaining those goals, such as standards. A prudent policy on acceptable exposure levels is important, however, and such policies should be revised and updated in accordance with new scientific knowledge. This may lead in some cases to the introduction of more stringent standards, while in other cases the standards may be shown to have been unnecessarily restrictive.

The management of health hazards might be improved in other ways, apart from setting standards or guidelines and using improved technology and control measures to attain them. Education and raising the awareness of individuals about the risks to which they are exposed and the personal opportunities that exist for avoiding and reducing these risks, is particularly relevant. The public perception of risks often differs from that of scientists and regulators. Risks that are familiar may be less threatening than those which are unfamiliar, and people may be more willing to accept a risk that they believe they can control, especially when they may derive a direct benefit from doing so.

Various actions should thus be taken, based on consideration of the nature of the risks, their amenability to control and the public's perceptions of the risks. Indicators of such actions do not illustrate an effect on the environment but reflect efforts to improve the environment and human health.

Box 17

EXAMPLES OF "ACTION" INDICATORS

Policy and planning

- Health and environmental policies and action plans in place at different levels
- Existence of a national sustainable development strategy
- Emergency preparedness plans for health and the environment
- Policies in place on the import, use, emission and disposal of toxic chemicals
- Measures taken to incorporate health issues in national environmental plans, and in sustainable development plans
- Measures taken to incorporate health and environmental issues in plans for such sectors as energy, transport and agriculture
- Existence of a ministry of the environment
- Formal mechanism or structure in place for involving major groups and partners in policy development at different levels
- Existence of legislation on:
 - Environmental/health impact assessment
 - Use of safety belts
 - Air, water, food standards, guidelines, regulations
 - Ratification of global agreements/conventions on health and the environment
 - Laws, regulations, bilateral and multilateral agreements for the control of transboundary pollution and the international transport of hazardous substances

(cont'd)

Service delivery and research

- Environmental and occupational health service delivery coverage and provision
- Annual number of inspections, statutory notices served, prosecutions
- Existence of monitoring and surveillance systems for environmental health hazards, including:
 - Evaluation and surveillance of food safety (for example HACCP)
 - Monitoring the generation, transport and disposal of hazardous wastes
 - Air monitoring (stationary and personal sampling)
 - Surface, ground and drinking-water surveillance
 - Tracking sentinel environmental diseases
 - Integrating health and environmental information
- Percentage of GDP spent on health and environmental health
- Environmental health expenditure as percentage of the total health budget
- Environmental health component of public health programmes
- Number and nature of school education programmes on the environment and health
- Number and nature of public education programmes on the environment and health
- Number of research institutes and universities involved in environmental health research
- Proportion of the health research budget spent on environmental health

8

ISSUE-SPECIFIC INDICATORS

In this chapter, examples are given of the way in which the framework could be used in developing indicators related to sectors such as housing, transport and agriculture, and health hazards associated with various environmental media, such as air and water. The lists presented are not exhaustive, but rather highlight issues, encouraging an integrative consideration of issues from different perspectives.

8.1 ISSUE: HOUSING AND SETTLEMENTS

While housing affords protection and shelter for people, it may frequently have a reverse effect and contribute in a variety of ways to ill-health and disease. Driving forces such as rapid urbanization may result in severe pressures due to lack of adequate shelter. For example, in many parts of the world housing lacks an adequate water supply and sanitation facilities, or there is inadequate surface water drainage and a lack of facilities for disposal of excreta and solid waste.

Personal, domestic and environmental hygiene may frequently be poor, and overcrowding may be a problem. Electricity is often absent, and people may rely on polluting fuels such as biomass, kerosene, coal or gas for cooking, heating and lighting. Food preparation facilities may be lacking, leading to potential contamination of food supplies. Housing construction and materials and fittings may also contain or emit dangerous substances such as radon, lead or asbestos. Lighting, ventilation and insulation may be inadequate, and the home may be structurally unsound and unsafe. Chemical and fire hazards may prevail when the home is used as a work place, and hazards associated with a wide range of occupational exposures may result. Owing to poor planning, settlements may also provide inadequate protection from floods, landslides, industry and traffic.

Such pressures may affect the state or quality of the environment in a number of ways, such as microbiological and chemical contamination of recreational and drinking-water supplies, contamination of food supplies, hazards leading to injuries and indoor air pollution. Pests, rodents, vermin and various pathogenic organisms may appear, and standing water may cause vector-breeding sites and dampness in the home.

A range of health effects may result from such exposures, including communicable diseases (for example respiratory conditions, gastrointestinal diseases, parasitic diseases, tuberculosis and measles) and non-communicable diseases and conditions such as lead poisoning, other chronic health-related conditions and skin conditions. Mental ill-health (for example stress-related anxiety, depression and neurobehavioural

disorders) may prevail, as well as social problems related to violence, crime, drugs and alcoholism. Accidents, injuries and burns in the home may also result.

These health effects could be minimized by the development of policies and programmes that might include better land-use planning and zoning measures, as well as upgrading of housing, housing design and construction measures. Relevant factors are the provision of low-cost housing, land and housing tenure, housing standards and enforcement measures aimed at incremental improvement of living conditions. Education and advocacy programmes with respect to housing and health issues are also important.

A selection of indicators associated with housing at various levels of the organizing framework is given below. Driving forces such as poverty and population growth rates are not specified separately, being common to most of the examples.

Box 18

EXAMPLES OF HOUSING - RELATED INDICATORS

Pressures

- Proportion of population living in poor housing conditions
- Proportion of population homeless
- Proportion of population living in sub-standard housing
- Proportion of households disconnected from water, electricity, gas supplies
- Proportion of population whose homes are not connected to a water supply system
- Proportion of population with inadequate excreta disposal facilities
- Proportion of population without domestic waste disposal services
- Housing and settlements that do not meet basic standards in respect of :
 - Housing quality
 - Water supply
 - Sanitation
 - Water drainage
 - Excreta and solid waste disposal
 - Domestic fuel use
 - Living space
 - Structural safeguards
 - Lighting, ventilation, insulation
 - Safety, chemical, fire hazards
 - Siting

State

- Exceedance of standards and guidelines for drinking-water, indoor air, noise
- Amount of standing water (vector-breeding sites)
- Prevalence of dampness in houses
- Prevalence of pests, rodents and vermin

Exposures

- Proportion of population whose drinking-water does not meet health standards
- Proportion of population exposed to indoor air pollution from coal and biomass burning

(cont'd)

- Proportion of population exposed to high levels of radon, dust lead levels
- Proportion of households/people exposed to excessive damp
- Proportion of households/people exposed to pests, rodents, vermin
- Proportion of households/people exposed to shelter that is structurally unsafe, or situated on unsafe land
- Proportion of people living in overcrowded conditions
- Proportion of households/people exposed to inadequate ventilation, lighting, or insulation, or to excessive noise

Health effects

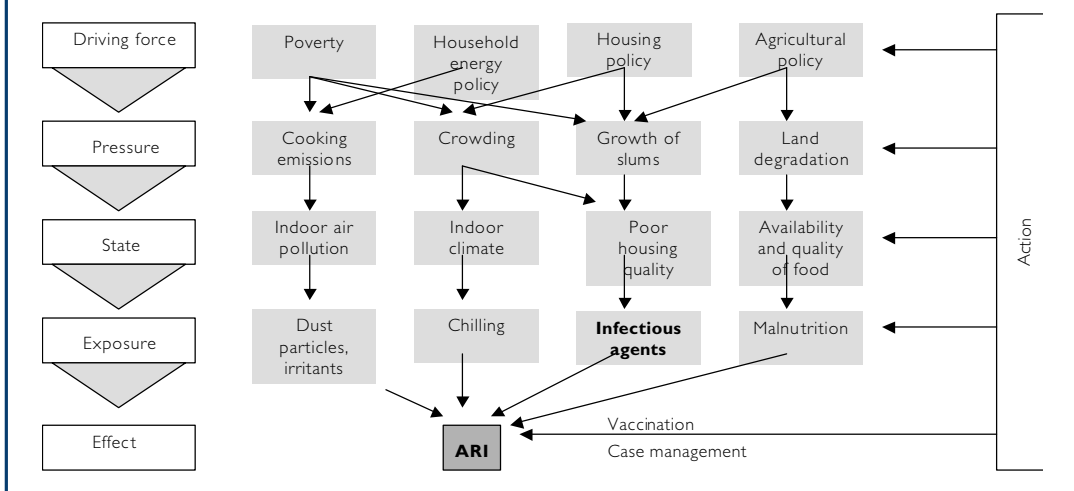
- Housing-related mortality and morbidity levels in respect of:
 - Accidents and injuries in the home
 - Communicable diseases (for example respiratory conditions, gastrointestinal diseases, parasitic diseases, tuberculosis, measles)
 - Lead poisoning, neurobehavioural disorders and other chronic ill-health conditions
 - Skin conditions (eczema, dermatitis, lice)
 - Psychological/mental ill-health conditions (stress-related, anxiety, depression)

Actions

Existence of:

- Land-use planning and zoning measures
- Service provision measures (water and sanitation, electricity, emergency services)
- Low-cost housing provision
- Housing legislation, standards, enforcement measures
- Housing upgrading, housing design and construction measures
- Land and housing tenure measures
- Impact assessment procedures for housing schemes

Figure 24
ACUTE RESPIRATORY INFECTIONS IN RELATION TO FACTORS ASSOCIATED WITH HOUSING



Further reading: Mara & Alabaster (100), WHO (7, 16, 95, 101)

8.2 ISSUE: TRANSPORT

The need for increased transport of people, materials, goods and products together with rising income levels and the desire for personal mobility have led to a rapid increase in motor vehicle ownership world-wide. In Thailand alone, for example, motor vehicle ownership has increased at an annual rate of 15% since the late 1980s. In China, the number of motor vehicles has tripled since 1984, from 2.4 million in 1984 to 9.4 million in 1994. By 2020, the urban vehicle population in China is expected to be 13 to 22 times greater than it is today (2).

Concomitantly with this increase in the number of motor vehicles, the combustion of fossil fuels has increased substantially, as has the release of gaseous pollutants and particulates. It is estimated that motor vehicles account for more air pollution than any other single human activity (102). For example, more than half of the global emissions of carbon monoxide, hydrocarbons and nitrogen oxides from fossil fuel combustion derive from automobiles, both gasoline- and diesel-powered, and the proportions may be significantly higher in city centres. Transport-associated emissions affect the state of the environment by increasing air pollution levels, particularly carbon monoxide, volatile organic compounds, hydrocarbons, nitrogen oxides, ozone and lead, as well as dust and particles.

Diseases and ill-health effects associated with transport include chronic respiratory illness, asthma, reduced lung function, cancer and heart disease, which might be caused or exacerbated by air pollution. Benzene and polyaromatic hydrocarbons from car exhausts and leaked oil and lubricants are recognized carcinogens, as are asbestos fibres.

Other effects include traffic accidents, which particularly affect children and young people. Road traffic accidents are the most common cause of unintentional injury world-wide. In 1990, they accounted for almost as much loss of healthy life as tuberculosis, and ranked ninth among all causes of disease and injury burden (8).

The large differences that still exist between developing and industrialized countries with regard to motor vehicle ownership have an impact on the trends in injuries and accidents. In developing countries, there are three motor vehicles for every 100 people, whereas in industrialized countries there are 50 motor vehicles for every 100 people. In New Delhi, 75% of people killed on the road are pedestrians, cyclists and motorcyclists, most of them hit by buses or trucks, and only 5% of those killed are drivers or passengers in cars. By contrast, in the United Kingdom, half the number of people killed on the roads are inside cars, and the overwhelming majority of pedestrians who die are killed by cars (103).

Not only are traffic accidents often a major cause of death among children, adolescents and young adults, but they are also the main cause of premature disability. Car traffic is also a major obstacle to urban accessibility for the elderly and the disabled. Mental ill-health effects may be significant, and factors such as noise, traffic jams and overcrowding of public transport may contribute to stress-related disorders. Transport and road traffic are the largest source of noise, ahead of building or industry. Odours

and smells may also be significant nuisances.

Various actions can be taken to decrease the risks of transport to human health. These include the production of safer, cleaner cars (for example cars with gas exhaust cleaning devices, electric- or solar-powered cars), improved vehicle inspection and maintenance programmes, changes in fuel characteristics and quality, reductions of automobile noise, exclusion of private cars from city centres, development of cycling paths and pedestrian areas, improvement of public transport (for example, railways, tramways and buses can be made less polluting, less noisy and safer), as well as the introduction of new public transport systems. Improved town planning measures can also reduce demand for transport, for example, by siting housing closer to work areas. Parking areas in the city can also be limited.

Box 19

EXAMPLES OF TRANSPORT- RELATED INDICATORS

Pressures

- Car use levels (for example passenger miles *per capita*)
- Vehicle ownership *per capita*
- Proportion of population regularly using public transport
- Average road traffic volumes, densities (cars, trucks, buses)
- Greenhouse gas emission levels by vehicle category
- Emission levels from transport vehicles (carbon monoxide, nitrogen oxides, ozone, hydrocarbons, particulates, lead, by vehicle category)
- Chlorofluorocarbon emission levels from vehicle air conditioners
- Proportion of vehicles failing maintenance/emissions tests

State

- Annual exceedance of air pollution standards
- Air pollution levels (carbon monoxide, volatile organic compounds, hydrocarbons, nitrogen oxides, ozone, lead, dust, particulates)
- Community noise levels in excess of standards
- Traffic density (vehicles per km)
- Vehicle accidents (number per km)
- Rates of traffic flow
- Prevalence of odours

Exposures

- Proportion of population living in proximity of dense traffic
- Proportion of population exposed to elevated concentration levels of traffic-derived air pollution
- Proportion of population exposed to air quality in excess of standards
- Proportion of population exposed to noise in excess of standards

Health effects

- Traffic-related mortality and morbidity levels in respect of:
 - Acute and chronic respiratory illness
 - Asthma

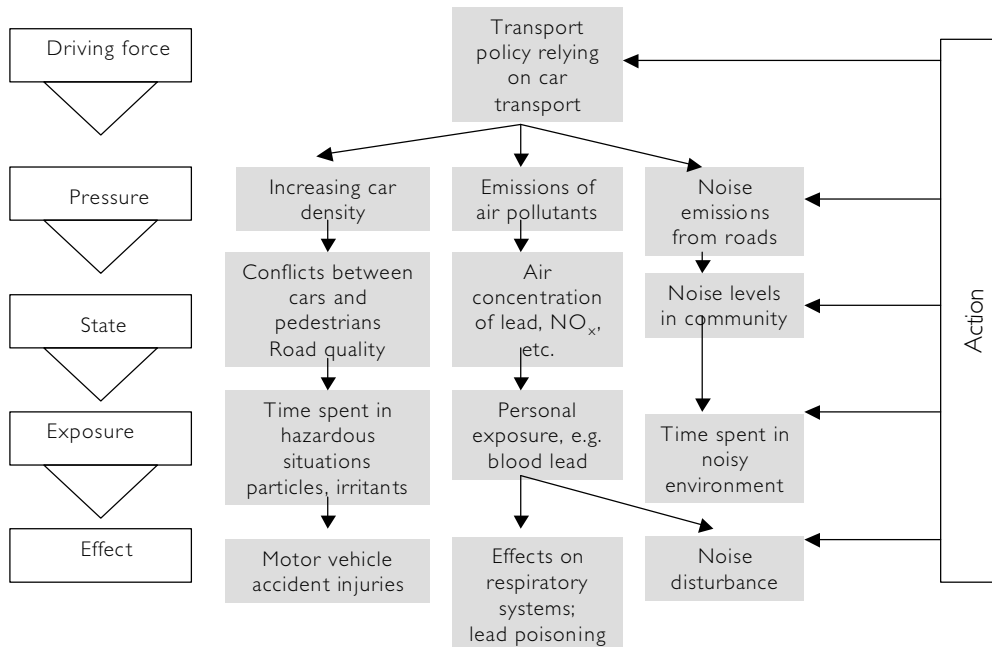
(cont'd)

- Reduced lung function
- Lung cancer
- Cardiovascular disease
- Injuries
- Mental health and stress-related disorders

Actions

- No. prosecutions, notices for breach of pollution regulations
- Expenditures on air pollution regulation and abatement equipment
- Expenditures on roads, public transport
- Production levels of safer, cleaner cars
- Proportion of vehicles with catalytic converters
- Number of cycling paths, pedestrianised areas
- Public transport schemes
- Existence of vehicle inspection and maintenance programmes
- Road surfacing programmes
- Existence of traffic reduction measures, noise barriers
- Integrated transport and town planning measures
- Impact assessment procedures for transport schemes

Figure 25
TRANSPORT



Further reading: WHO (7, 16), World Resources Institute (2)

8.3 ISSUE: AGRICULTURE

Despite its obvious benefits, agriculture may have a negative impact on health, through various water resource development schemes, irrigation schemes, indiscriminate use of fertilizers and pesticides and land and resettlement policies (95). For example, there is well-documented evidence that the construction of water impoundments for agriculture may accelerate transmission of schistosomiasis in endemic areas and of diseases such as malaria, filaria and dracunculiasis (for example in Ghana). Small impoundments used by local populations for fishing, water supply, animal watering, irrigation and flood control may be health hazards.

Irrigation systems, particularly those situated in the tropics, may introduce or increase the transmission of a number of vector-borne or water-related diseases. More than 30 diseases have been linked to irrigation, the major vector-borne diseases including schistosomiasis, malaria, onchocerciasis and Japanese encephalitis. Various changes in the state of the environment which may increase vector breeding include simplification of the habitat, increasing the area of surface water, raising the water table, changing the rate of water flow and changes in the microclimate. The absence of proper drainage systems in irrigation schemes is one of the most important factors in the spread of vector-borne disease.

Agricultural projects in forested ecosystems carry particular risks. For example the prevalence of leishmaniasis has increased in regions such as Brazil and the southern parts of the former USSR, and the opening up of the Amazon area in Brazil to farming and ranching has resulted in a resurgence of malaria, particularly in settlements, mining areas and peri-urban districts (16). Deforestation itself carries many indirect risks: for example, people may have difficulty in obtaining wood for fuel, rainwater may become erratic, and irrigation schemes may be threatened. Farming may also affect health, for instance, through contamination of groundwater, aquifers and surface waters by fertilizers and animal wastes. Drainage water with high salinity and excess nutrients also contributes to the contamination of water supplies.

Many actions can be taken to limit the negative impacts of agriculture on human health. These include better formulation of fertilizers and avoidance of excessive use, crop rotation and modification of other crop husbandry practices and appropriate and integrated pest control measures (for example combinations of traditional environmental, biological and chemical pest control methods). Other actions might include the development of technology for reducing dependence on agrochemicals and the application of water-conservation techniques. Accident prevention measures and immunization programmes are important, as are measures such as literacy programmes and initiatives for income generation, land tenure changes and urban agriculture, as well as sound food and nutrition policies. Reallocation of land unused or underused by large landowners to small farms could result in significant increases in incomes for many people, as well as increase the food supply, as was shown in a case study in Northeast Brazil (16).

Box 20

EXAMPLES OF AGRICULTURE - RELATED INDICATORS

Pressures

- Deforestation/reforestation rates
- Agricultural land conversion rate
- Fraction of arable land with resource development schemes, irrigation schemes
- Fraction of arable land with drainage systems
- Amount of pesticides used annually
- Amount of organic wastes per unit of product
- Amounts of nitrogen and phosphorus fertilizers used annually
- Amounts of agricultural chemicals used annually
- Land and resettlement policies

State

- Desertification rate/index
- Threatened ecosystems by area
- Extent of land degradation
- Changes in water flow rate
- Increase in surface water rate
- Exceedance of standards and guidelines for drinking-water recreational water, irrigation water
- Fraction of soil contaminated by chemicals and residual pesticides
- Pesticide residue levels in drinking-water
- Concentrations of nitrates, nitrites, phosphates in drinking-water
- Levels of contamination of groundwater, aquifers and surface waters
- Salinity and nutrient levels in drainage water

Exposures

- Proportion of population whose drinking-water supplies do not meet health standards
- Fraction of workers lacking protective equipment
- Fraction of population using impoundments for fishing, water supply and irrigation
- Proportion of population exposed to disease vectors (mosquitoes, snails etc.)

Health effects

- Agriculture-related morbidity and mortality levels in respect of:
 - Schistosomiasis, malaria, onchocerciasis, typhoid, cholera, shigella, diarrhoea, leishmaniasis
 - Acute poisoning due to specific causes
 - Malnutrition in children

Actions

- Reduction in use of fertilizers
- Reformulation of fertilizers

(cont'd)

- Use of crop rotation measures
- Existence of improved crop husbandry measures
- Use of integrated pest control measures
- Application of water-saving technologies
- Existence of adequate accident prevention measures
- Existence of immunization programmes
- Existence of sound food and nutrition policies
- Existence of worker protection measures, for example protective clothing
- Existence of improved land tenure practices

Further reading: WHO (7, 16, 95), World Resources Institute (2)

8.4 ISSUE: AIR

Many different driving forces such as urbanization and industrialization and activities associated with transport and energy may give rise to air pollution. The largest source of air pollution is the combustion of fossil fuels in power plants and by industries, motor vehicles and households. Particularly high levels of air pollution can occur around point sources and in areas where the topography limits atmospheric dispersion of pollutants, especially under adverse meteorological conditions.

It is now well established that a relationship exists between exposure to air pollution and health effects in human beings. It is estimated that about three million deaths occur globally each year due to air pollution, mainly by particulate matter (7). Other pollutants of concern to health include ozone, sulfur dioxide, nitrogen dioxide and carbon monoxide. There may occur acute health effects, for example, associated with severe air pollution episodes, and chronic effects, often associated with relatively low levels of air pollution. Air pollution may result not only in overt health effects but may also be a considerable nuisance, causing irritation of the eyes and mucous membranes and objectionable odours.

The health effects of air pollution have been a concern for centuries but assumed greater significance during and after the Industrial Revolution. Acute air pollution episodes such as those which occurred in the mid-twentieth century led to a dramatically increased awareness of the magnitude of the health effects. In many of these episodes, adverse environmental conditions together with such factors as temperature inversions contributed to the accumulation of aerosol and gaseous pollutants such as sulfur dioxide and particulates. For example, in 1930 an episode in the Meuse River Valley in Belgium was responsible for the deaths of 63 people (mainly elderly people and those suffering from heart or lung ailments), and ill-health effects were recorded in thousands of individuals. A similar episode occurred in Donora, Pennsylvania, USA, in 1948, and the famous London smog episode in 1952 is thought to have been responsible for the excess deaths of nearly 4000 people. Many other acute episodes have since occurred in the USA and elsewhere, including South-East Asia as a result of the recent forest fires.

The wide range of health effects that may occur includes chronic obstructive pulmonary disease (for example emphysema and bronchitis), asthma, acute respiratory infections (for example pneumonia), cardiovascular disease and lung cancer. The actual health effects that result depend on many factors relating to the source of pollution, its physical and chemical composition, exposure levels, and characteristics of the population at risk, such as health and nutrition status and age.

In addition to ambient air pollution associated with industry and transport, indoor air quality is becoming an important problem. Those most vulnerable to the effects of air pollution (the young, the old and the sick) spend most of their time indoors, where they may be significantly exposed. Indeed, the highest exposures to air pollution occur in the indoor environment in developing countries, mainly from biomass and coal combustion for cooking and heating. Other pollutants may originate from cigarette smoke, construction materials and methods, materials for furniture and fittings, paints and solvents. The indoor environment can also be affected by pollutants in the ambient environment, and vice versa.

Box 21

EXAMPLES OF AIR POLLUTION - RELATED INDICATORS

Pressures

- Number/type of polluting industries
- Number of new industries per year
- Number of vehicles using leaded/unleaded gasoline, diesel fuel
- Consumption levels of leaded gasoline
- Average road traffic volumes, densities
- Proportion of households using wood, gas/coal stoves, electricity
- Domestic consumption levels of gas, coal, biomass
- Production and consumption of products containing ozone-depleting substances
- Annual air pollutant emissions from major industrial facilities, vehicular transport
- Incidence of accidental releases of toxic chemicals, radioactive substances

State

- Pollutant concentration levels in urban air
- Annual concentration levels of ozone-depleting substances in air
- Global atmospheric concentration levels of greenhouse gases
- Indoor air pollution levels
- Number of severe air pollution incidents per year
- Number of hours/days per year during which air pollutants exceed standards (sulfur dioxide, particulates, nitrogen oxides, ozone, lead etc.)

Exposures

- Proportion of population exposed to ambient air pollution levels in excess of standards
- Proportion of population living in proximity to sources of air pollution (traffic, industrial activities)

(cont'd)

- Proportion of population exposed to indoor air pollution from coal and biomass-burning
- Proportion of population with raised blood lead levels, cotinine levels
- Proportion of population exposed to high levels of radon or lead dust in their homes

Health effects

- Air pollution-related mortality and morbidity levels with respect to:
 - Acute respiratory infections
 - Chronic respiratory disease
 - Asthma
 - Lung cancer
 - Sick-building-syndrome associated symptoms
 - Eye irritations, irritation of mucous membranes
 - Neurobehavioural effects (for example lead)

Actions

Existence of:

- Air quality standards
- Emission standards
- Vehicle inspection programmes
- building codes concerning ventilation/indoor air
- household electrification programmes
- improved town planning/zoning measures
- clean fuels, clean technology programmes
- improved public transport programmes
- clean air policies (public spaces)

8.5 ISSUE: WATER

Water availability and water quality have marked effects on human health. Over 1000 million people (mainly in rural areas, but increasingly also in urban and peri-urban areas) do not have access to an adequate or safe water supply. Untreated or inadequately treated water contaminated by excreta, sewage, industrial, agricultural and domestic waste presents a significant health risk. Both microbial agents and chemicals can enter the water supply from such sources and are not always effectively removed at water treatment plants.

Biological, chemical and physical contamination of water may be associated with widespread mortality and morbidity. For example, increased nitrate concentrations and potentially harmful pesticides in drinking-water may result from certain agricultural practices. Trihalomethanes may result from the chlorination of water with a high organic content. Old lead plumbing, solder and fittings may contaminate the water supply.

“Natural” pollutants such as arsenic and fluoride may also occur in water supplies.

Historically, the majority of water-related health problems have concerned infectious waterborne diseases rather than chemical contamination. John Snow, in his classic investigation of the cholera epidemic in London in 1853, was among the first to make the association between water pollution and infectious disease. Water-related diseases, which are still a major cause of morbidity and mortality in developing countries, include among others typhoid, cholera, hepatitis A and gastroenteritis. Gastrointestinal infections may reduce absorption of nutrients and affect the general defence mechanisms of the body, and this in turn can cause susceptibility to diseases such as measles and pneumonia. Other water-related health effects include vector-borne diseases such as malaria, schistosomiasis, trypanosomiasis, filariasis and yellow fever.

Quite different problems arise from the presence of arsenic (for example in Asia and Central America), or fluoride, for instance. Excessive exposure to fluoride may result in skeletal fluorosis, and exposure to high levels of arsenic may result in skin diseases, cancer and neurological disorders. The degree of softness of the water may be a factor in cardiovascular disease. Lead in drinking-water may contribute to increased body lead burdens in the population and to health effects such as neurobehavioural problems in young children and certain haematological abnormalities. Such problems are increasingly affecting both industrialized and developing countries: for example, the incidence of communicable diseases associated with water is growing in industrialized countries, while the chemical contamination of water is increasing in developing countries.

The contamination of lakes, rivers and coastal waters can also cause health-related problems when such bodies are used for recreation. Studies in various parts of the world have shown that increased rates of infection are associated with direct contact (for example bathing, diving, surfing) and indirect exposure (seafood consumption). The potential health effects include a variety of diseases such as gastroenteritis, respiratory, ear, eye and skin infections, hepatitis A, cholera and typhoid.

Actions taken to prevent and control water-related diseases might include a range of measures to provide a safe, sufficient, accessible water supply and the hygienic disposal of wastes, which are the two fundamental factors in disease prevention. This was recognized by the United Nations when it declared the 1980s to be the “International Drinking Water Supply and Sanitation Decade” (7).

Box 22

EXAMPLES OF WATER - RELATED INDICATORS

Pressures

- Amount of freshwater/coastal waste water discharges
- Amount of industrial/municipal effluents (treated/untreated discharges)
- Tonnes of sewage discharged into water bodies
- Lead plumbing in drinking-water systems
- Discharges of domestic and industrial waste water into surface water
- Water consumption levels by use per/capita

State

- Proportion of drinking-water sources microbiologically or chemically contaminated
- Proportion of recreational surface waters not meeting bathing water quality standards
- Exceedance of standards, guidelines related to drinking-water, recreational, fresh and marine waters, aquaculture and irrigation waters
- Proportion of inland surface waters not meeting standards for the preparation of drinking-water
- Water hardness, colour, taste, pH, biological oxygen demand, chemical oxygen demand etc.

Exposures

- Proportion of population whose homes are not connected to a water supply system
- Proportion of population whose drinking-water supplies do not meet health standards
- Proportion of population without access to safe drinking-water

Health effects

- Water-related morbidity and mortality levels in respect of:
 - Tropical diseases, malaria, schistosomiasis, typhoid, cholera, polio, hepatitis A, filariasis, yellow fever
 - Other viral, bacterial and parasitic diseases
 - Gastroenteritis
 - Number of outbreaks of waterborne disease
 - Eye, ear and skin infections
 - Drowning
 - Neurodevelopmental effects
 - Methaemoglobinaemia

Actions

- Provision of safe, sufficient, accessible water supplies
- Existence of adequate waste management systems
- Existence of effluent standards and drinking- and bathing-water standards

APPENDICES

APPENDIX 1

UNION OF SELECTED CORE INDICATOR SETS

Topics/indicators	MNS- DS ¹	OECD/DAC- United Nations- WB ²	UND- AF/ CCA ³	BSSA ⁴	CSD ⁵
1. Population and population growth					
Estimated population size by age and sex ⁶	×				
Total population ⁷		×	×	×	
Total fertility rate		×	×		
Population growth rate					×
Population of urban formal and informal settlements					×
2. Health and mortality					
Life expectancy at birth	×	×	×	×	×
Under-five mortality rate	×	×	×	×	×
Proportion of population with access to primary health care services			×	×	×
Infant mortality rate	×	×	×	×	
Human immunodeficiency virus (HIV) adult prevalence rate			×		
HIV prevalence in pregnant women aged 15-24 years ⁸		×	×		
Mortality and morbidity due to selected key illnesses					×
3. Reproductive health					
Maternal mortality rate (per 100,000 live births)	×	×	×	×	

Topics/indicators	MNS- DS ¹	OECD/DAC- United Nations- WB ²	UND- AF/ CCA ³	BSSA ⁴	CSD ⁵
Contraceptive prevalence rate	×	×	×	×	×
Percentage of births attended by appropriately trained health/skilled personnel		×	×		
4. Food security and nutrition					
Percentage of household income spent on food			×		
Percentage of population below minimum level of dietary energy consumption			×		
Proportion/prevalence of underweight children ⁹		×	×	×	×
5. Education					
Adult literacy rate		×	×	×	×
Net primary enrolment ratio		×	×		
Percentage reaching grade 5/ completion of grade 4		×	×		
Average number of years of schooling completed ¹⁰	×				×
Literacy rate of those aged 15-24 years ¹¹		×	×		
6. Gender equality and women's empowerment					
Percentage of seats held by women in national government, including parliament			×		
Percentage of paid employees who are women			×		
Ratio of girls to boys in primary and secondary education combined ¹²		×	×	×	
Ratio of average female wage to male wage					×
7. Child health/welfare					
Percentage of one-year-old children immunized against measles ¹³			×		×
Percentage of children under age 15 living outside their own home					×
Percentage of children aged 10-14 years who are in employment			×		

Appendix 1. Union of Selected Core Indicator Sets

Topics/indicators	MNS- DS ¹	OECD/DAC- United Nations- WB ²	UND- AF/ CCA ³	BSSA ⁴	CSD ⁵
8. Employment					
Unemployment rate	×		×		×
Informal sector employment as percentage of total employment			×		
Employment-population ratio ¹⁴	×		×		
9. Income and poverty					
Household income per capita (level and distribution)	×				
Poverty headcount ratio (percentage of population below national poverty line)			×		×
Poverty headcount ratio (percentage below US\$1 a day)		×	×		
Poverty gap ratio		×	×		
Monetary value of the minimum food basket ¹⁵	×				
Poorest fifth's share of national consumption		×	×		
Gini index of income inequality					×
10. Housing and basic household amenities and facilities					
Percentage of population with access to adequate sanitation ¹⁶	×		×	×	×
Percentage of population with access to safe drinking-water	×	×	×	×	×
Number of persons per room, excluding bathroom ¹⁷	×		×	×	×
11. Environment					
Arable land per capita ¹⁸			×		×
Percentage change in forest land area in the last 10 years			×		
Percentage of the population that relies on traditional fuels for energy use			×		
Countries with national sustainable development strategies		×			×
Intensity of fresh water use		×			
Biodiversity land area protected		×	×		×

Health in Sustainable Development Planning: The Role of Indicators

Topics/indicators	MNS- DS ¹	OECD/DAC- United Nations- WB ²	UND- AF/ CCA ³	BSSA ⁴	CSD ⁵
Energy efficiency: gross domestic product (GDP) per unit of energy use ^{1 9}		X	X		X
Carbon dioxide emissions (per capita)		X	X		
Forest area as percentage of land area		X			X
Mangrove areas		X			
Urban air pollution		X			X
Intensity of material use					X
Annual energy consumption per capita					X
Share of consumption of renewable energy resources					X
Generation of industrial and municipal solid waste					X
Generation of hazardous waste					X
Generation of radioactive waste					X
Waste recycling and reuse					X
Distance travelled per capita, by mode of transport					X
Emissions of greenhouse gases					X
Consumption of ozone-depleting substances					X
Use of fertilizers					X
Use of agricultural pesticides					X
Wood-harvesting intensity					X
Land affected by desertification					X
Area of urban formal and informal settlements					X
Algae concentration in coastal areas					X
Total population in coastal areas					X
Annual fish catch by major species					X
Annual withdrawal of ground water and surface water as percentage of total available water					X
Oxygen demand in water bodies					X

Appendix 1. Union of Selected Core Indicator Sets

Topics/indicators	MNS-DS ¹	OECD/DAC-United Nations-WB ²	UND-AF/CCA ³	BSSA ⁴	CSD ⁵
Concentration of faecal coliform in fresh water					×
Area of selected key ecosystems					×
Abundance of selected key species					×
12. Drug control and crime prevention					
Area under cultivation of coca, opium, poppy and cannabis			×		
Number of crimes per 100,000 inhabitants ²⁰			×		×
Prevalence of drug abuse			×		
Seizures of illicit drugs			×		
13. Economics					
Total gross national product (GNP)			×		
GNP or GDP per capita ²¹	×	×	×		×
External debt (United States dollars) as percentage of GNP		×	×		×
Decadal growth rate of GNP per capita (United States dollars)			×		
Investment as percentage of GDP		×			×
Trade as percentage of GDP ²²		×	×		
Aid as percentage of GDP		×			×
Share of foreign direct investment (FDI) in GDP			×		
Percentage of public expenditures on social services					
Balance of trade in goods and services					×
14. Institutional capacity					
Implementation of ratified global agreements					×
Number of radios or Internet accounts per 1,000 inhabitants					×
Main telephone lines and cellphones per 1,000 inhabitants					×
Expenditure on research and development as percentage of GDP					×
Economic and human loss due to natural disasters					×

Health in Sustainable Development Planning: The Role of Indicators

- ¹ Minimum National Social Data Set (see E/CN.3/1999/14).
- ² Organization for Economic Cooperation and Development (OECD)/Development Assistance Committee (DAC)-United Nations-World Bank indicators for international development goals (<http://www.oecd.org/dac/indicators/htm/list.htm>).
- ³ United Nations Development Group, "Guidelines: common country assessment", final draft, 31 March 1999, annex A, box A (Conference indicators) and box C (Contextual indicators). The framework also contains some qualitative indicators on governance and civil and political rights.
- ⁴ Basic Social Services for All (BSSA) Indicators (Administrative Committee on Coordination (ACC) Task Force on Basic Social Services for All).
- ⁵ Indicators for sustainable development proposed by the Commission on Sustainable Development (CSD); this framework is currently under revision and will be finalized at the ninth session of the Commission in 2001.
- ⁶ MNSDS: where appropriate and feasible, by ethnic group.
- ⁷ United Nations Development Assistance Framework (UNDAF); by age, to identify targets groups.
- ⁸ OECD: use Adult rate if data not available; UNDAF: HIV prevalence in pregnant women under age 25 who receive antenatal care in capital cities/major urban areas.
- ⁹ UNDAF: children under age 5 underweight, stunted and wasted; Commission on Sustainable Development: nutrition status of children.
- ¹⁰ MNSDS: by urban/rural and, where possible, by income class; Commission on Sustainable Development: secondary or primary school completion ratio.
- ¹¹ OECD: in addition, ratio of literate females to males.
- ¹² UNDAF: only secondary education.
- ¹³ Commission on Sustainable Development: immunization against infectious childhood diseases.
- ¹⁴ MNSDS: where appropriate, by formal and informal sector.
- ¹⁵ MNSDS: food needed for minimum nutritional requirement.
- ¹⁶ Commission on Sustainable Development: percentage of population with adequate sewage disposal facilities.
- ¹⁷ UNDAF: if data are not available, floor area per person.
- ¹⁸ Commission on Sustainable Development: arable and permanent crop land area.
- ¹⁹ Commission on Sustainable Development: intensity of energy use.
- ²⁰ Commission on Sustainable Development: number of reported crimes per 1,000 population.
- ²¹ UNDAF: United States dollars and purchasing power parities (PPPs).
- ²² UNDAF: share of exports in GDP.

Source: UN (45)

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AND BOXES**

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