Environmental Assessment and Human Health: Perspectives, Approaches and Future Directions

A background Report for the International Study of the Effectiveness of Environmental Assessment

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IAIA International Association for Impact Assessment

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About this Report

Health is an important but often neglected component of environmental assessment (EA). This report, prepared for the International Study of EA Effectiveness, draws on both Canadian and international experience on the subject. It reviews key perspectives and approaches to including health considerations as an integral part of the EA process. Although primarily intended as a discussion paper, the report also provides an introduction to the information, procedures and tools available for undertaking what is sometimes called 'environmental health impact assessment' (EHIA). The report concludes with an agenda of further actions necessary to promote this emerging field.

Preface

Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

U.N. Conference on Environment and Development, Rio de Janeiro, 1993

Environmental Assessment has been increasingly used by decision-makers to examine the ecological and related health, social, economic and cultural implications of proposed human activities. A significant change which has, or is occurring within environmental assessment, is the clear recognition that the assessment of human health effects is an important component of environmental assessment. As a result health professionals are being called upon, at a much greater frequency to participate in the environmental assessment process.

The recently released International Study on the Effectiveness of Environmental Assessment identified social and health impact assessment as areas that are insufficiently considered or are inadequately treated in project environmental impact assessment.

This background report[1] for the effectiveness study was cooperatively funded by Health Canada, the Canadian Environmental Assessment Agency, Environment Canada and the Canadian International Development Agency and expands upon the relationship of health and environmental assessment. It provides: further clarification on the role of health in environmental assessment; an overview of the current status of health assessment at the international level; details on how health can be included in an environmental assessment; and, key priorities and needs for improving health impact assessment.

The authors draw on both Canadian and international experience on the subject. The report reviews key perspectives and approaches to including health considerations as an integral part of the environmental assessment process. Although primarily intended as a discussion paper, the report also provides an introduction to the information, procedures and tools available for undertaking what is sometimes called 'environmental health impact assessment' or EHIA.

It is recommended that the International Association for Impact Assessment promote scientific thinking on health impact assessment by:

- sharing information and fostering communication among countries on Health Impact Assessment;
- encouraging coordination and harmonization of approaches to Health Impact Assessment;
- providing the educational tools required to promote or increase awareness of environmental/ human health assessment, risk assessment and communication; and
- providing guidelines, manuals and interpretational tools on the linkages among environmental, social, economic, cultural and human health effects.

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1. This report is published in both English and French and will be available, after July 1st, 1997, on the Homepage of Health Canada's Office of Environmental Health Assessment at http://www.hwc.ca/dataehd/English/dgo/oeha

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1. Introduction

"Health depends on our ability to understand and manage the interaction between human activities and the physical and biological environment. We have the knowledge for this but have failed to act on it".

(World Health Organization, 1992)

Health, Environment and Assessment

The growth of a global industrial society has had profound effects on human health and the environment. For the first time in recorded history, human activities are causing ecological disruption at a global scale. Environmental degradation is now both widespread and increasing; world-wide, for example, emissions of harmful pollutants are projected to double in the next 15 years (Brown et al., 1995) and it is now becoming increasingly clear that development can have adverse, as well as beneficial effects on health and well-being.

As a result of this situation, many governments and international agencies recognize the need to further strengthen the role of environmental and health considerations in decision-making processes. Over the last 25 years, environmental assessment (EA) has evolved into an institutionalized process for identifying, assessing and mitigating the potential environmental effects of development projects and for informing decision makers. Since the 1970s, the scope of EA has broadened considerably to include related health and other social considerations. Often, however, health aspects are inconsistently or partly addressed in EA processes and the need for a more systematic approach has been well documented (e.g., Martin, 1986; Giroult, 1988; Davies, 1991; Turnbull, 1992; Ewan et al., 1993; Arquiaga et al., 1994).

Box 1 Health Considerations in Environmental Impact Statements in the United States

Eleven case studies were comparatively reviewed by Arquiaga, Canter and Nelson (1994) as part of an evaluation of the need for an integrated methodology for health impact prediction and assessment. Their key findings were:

- Only four of the 11 cases addressed health and associated risk and/or hazards, a more thorough analysis of their effects could have been incorporated in at least two of the four cases: some of the remaining cases should have given greater attention to health consequences and the two most thorough assessments generally treated health impacts in the appendices to the main body of the EIS.
- Of the four EISs that addressed health impacts, one incorporated a guideline approach, two used a formalized risk assessment methodology, and one used a combination qualitative quantitative approach.

Based upon the case studies and a methodological review, the authors proposed a systematic methodology for health impact prediction and assessment. This is based on an amalgam of the generic EIA methodology proposed by the World Health Organization, the use of a targeted approach involving empirical indices and the conduct of probabilistic risk assessment and is organized around 10 steps or activities typically undertaken in an EA.

The World Health Organization has defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 1947) and as "the extent to which an individual or a group is able, on the one hand, to realize aspirations and to satisfy needs, and on the other to change or cope with the environment".

(World Health Organization, 1984)

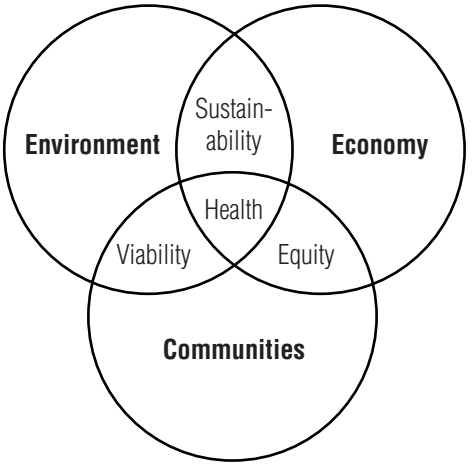
At the same time, perspectives on and knowledge about health have improved dramatically. For example, it is now generally accepted that health is much more than the absence of disease and includes social and psychological well-being, as well as the capacity to respond to the changing circumstances and conditions of life. Consistent with this understanding, a recent Canadian report has identified the major determinants of health (Advisory Committee on Population Health, 1994):

Box 2 Determinants of Health

- Income and social status;
- Social support networks;
- Education;
- Employment and working conditions;
- Physical environments;
- Biology and genetic endowment;
- Personal health practices and coping skills;
- Healthy child development; and
- Health services.

As indicated in Box 2, the quality of the biophysical environment, supportive communities and economic development all have a vital role in maintaining and improving human health.

So defined, human health is an overarching goal of sustainability, lying at the intersect of its environmental, economic and social pillars. Their interrelationships are elaborated schematically in the accompanying figure. Economic development, a key concern for industrial and developing countries, is a central focus for analyzing health benefits and costs. For example, economic development can benefit health by improving standards of living, providing jobs, and yielding tax revenues to help pay for health, educational and social services.



Sadler and Jacobs (1992)
Modified from Hancock (1990)

"Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature". Principle 1. The Rio Declaration on Environment and Development.

On the other hand, development can cause adverse effects on health and well-being including:

- Effects on physical health such as mortality and morbidity due to communicable and non-communicable diseases and injuries;
- Effects on psychological well-being such as stress, anxiety, alienation and feelings of a loss of control over one's life; and
- Effects on social and community health such as the loss of cultural identity and quality of life, social disruption and violence, and a breakdown of community and family support networks.

Box 3 Health in Sao Paulo State, Brazil

The public health system operates in a precarious fashion. Large urban agglomerations are threatened by the return of diseases previously thought to have been eradicated, a threat directly caused by shortages of funds and health professionals as well as by the inadequacies in medical services and the incomplete coverage of basic sanitation (water and sewers) facilities. The mortality rate for communicable diseases is 25 deaths per 10,000 (Secretariat for the Environment, 1992).

Secretariat for the Environment 1992. Sao Paulo 92 Environmental Profile and Strategies, Sao Paulo: "Centro de Editoracao".

Despite its centrality and importance, health is rarely seen as an explicit priority in decisions about development (World Health Organization, 1992). With the broadening of EA to include health, there is both reason and opportunity to give health considerations a greater priority in all aspects of development decision making.

The International Effectiveness Study and Report Objectives

Since its inception in the early 1970s, EA has become recognized as an important process for anticipating and preventing the adverse effects of development projects. Yet EA is also widely seen as falling short of realizing its full potential. Unless EA can adapt to the ongoing and rapid changes in global conditions and global conditions can be accepted as an essential element of other types of decision-making processes, it will become increasingly marginalized and less relevant.

Environmental health can be defined as "the aspect of public health concerned with all the factors, circumstances and conditions in the environment...that can exert an influence on human health and well being".

(Lash, 1987)

In response to these concerns, health was identified by the international study of the effectiveness of environmental assessment as an important area for process development. Environment and health, by definition, encompass a broad policy and research agenda and constitute a cross-disciplinary focus for developing integrated approaches that link biophysical, social and economic factors in assessment. This background report of the effectiveness study reviews current and potential approaches for incorporating health considerations more firmly into the EA process. It draws on both Canadian and international experience to develop perspectives on and recommendations for more effective practice in this area. Our discussion also touches on the complex relationship of environmental quality and human health (see Davies, 1991), the challenges associated with identifying and estimating cause-effect relationships (see Green and Orleans, 1994), the ongoing theoretical debate regarding the nature of science and appropriate methods for dealing with equivocal evidence (see Eyles, 1994) and emerging sustainability frameworks that link ecosystem and human health (see Boyden, et al., 1993).

This paper's objectives are:

- To analyze the major challenges associated with integrating health concerns into EA;
- To identify some generic principles and practical measures to improve the consideration of health issues in EA; and
- To discuss possible future directions for integrating health factors into EA.

It is organized into six sections. Following this introduction, there is a brief summary of the benefits of including health in EA. Section 3 outlines the current status of health and EA. Section 4 discusses how health is included in EA processes in more detail. Section 5 describes some of the major priorities and needs. Section 6 lists the references. Appendix A contains a selected bibliography and a list of contacts, and Appendix B summarizes the European Union's environment and health principles for public policy.

2. Benefits of Including Health in EA

Several benefits are gained by including health in EA:

Contribute to 'Health for All' and Sustainable Development

In 1977, the World Health Assembly resolved that *"the main social target of governments and the World Health Organization in the coming decades should be the attainment by all citizens of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life"* (World Health Assembly, 1977). Since then, many countries have endorsed this target and developed goals and strategies to achieve 'health for all'. The promotion of this concept encompasses explicit recognition of the importance of "supportive environments for health", including clean air and water.

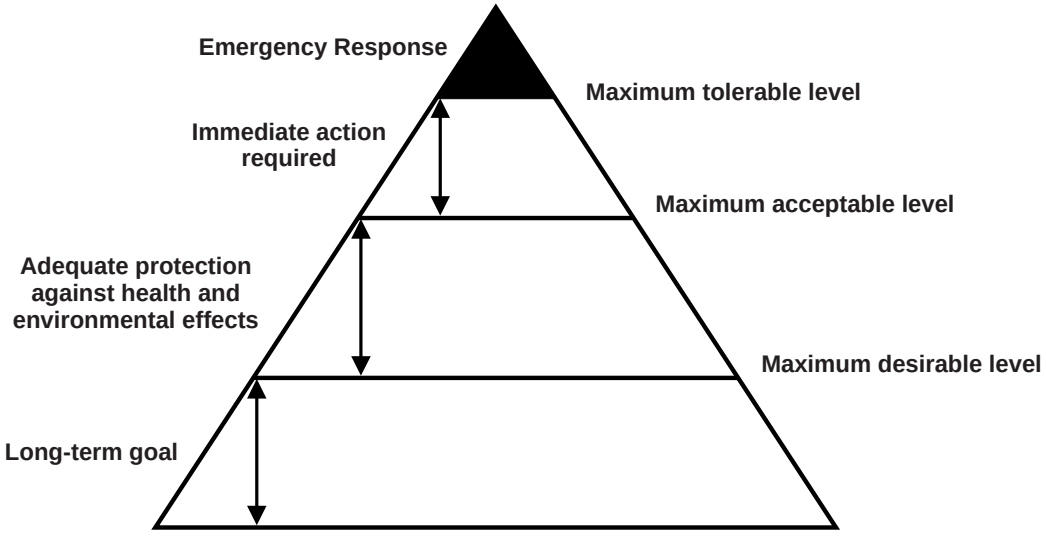
Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

(World Commission on Environment and Development, 1987)

More recently, human health and well-being were recognized as the ultimate goal of sustainable development. The World Commission on Environment and Development (1987) report on 'Our Common Future' emphasized the need for economic growth to enable the four-fifths of the world's population currently living in poverty to attain a reasonable level of health, while ensuring that this growth does not harm the environment, thereby foreclosing opportunities for future generations. In the context of sustainability, human health is inextricably linked to ecological health and the maintenance of genetic diversity, natural processes and life support systems. This relationship is at the centre of the World Conservation Strategy (IUCN et al., 1990) and is also an integral theme of Agenda 21, the global programme of action agreed to at the Earth Summit.

As documented in these and other reports, achieving 'health for all' and sustainable development will require a broad range of cross-sectoral strategies that go well beyond the traditional domain of the health sector and include other policy sectors, such as environment and natural resource management, economic development, education, housing and agriculture. Indeed, it is widely recognized that further improvements in health will require significant efforts from many different sectors of society. With its emphasis on cross-sectoral collaboration and multi-disciplinarity, EA is an important means of contributing to 'health for all' and sustainable development.

Canada's Tiered System of Quality Objectives



Source: Government of Canada (1991, 2-10)

Minimize Adverse Effects on Health and Maximize Beneficial Ones

EA can help to minimize or eliminate the adverse health effects of development by identifying appropriate mitigation measures. Many mitigation measures used for environmental protection will also minimize adverse effects on human health, with consequent economic savings. At a local level, for example, the air and water pollution control strategies that are widely applied in industrialized countries help ensure that concentrations of contaminants meet health and environmental quality standards (see figure). By contrast, industrialization in many developing countries often goes unassessed and unregulated, imposing substantial public and occupational health costs (Dauida, 1989, see Case Examples 1, 2).

Case Example 1 Radioactive Fallout from the Chernobyl Explosion

The 1986 explosion at the Chernobyl nuclear plant (130km north of Kiev) was the world's worst technological disaster. An estimated 120-150 million curies of radioactivity contaminated a 160,000km^2 area of Belarus, Russia and Ukraine. Environmental health impacts can be analyzed by reference to three main exposure zones: 1) on-site (up to 1km radius) 2) the so-called exclusion zone (1-30km) and the downwind contamination plume (30-2,000km).

Due to the latency period associated with radiation effects, a true picture of the consequences of the Chernobyl accident will remain incomplete for some time. However, preliminary evidence indicates that cancer mortality and sickness rates are alarmingly high among those who fought the fire and sealed the reactor core. In western Scotland, which was reached by the radioactive plume, at a time of heavy rainfall, high levels of radioactive caesium were detected (20,000 to 40,000 becquerels/m^2) on Rannoch Moor and unusually high cancer clusters are being investigated in remote communities (e.g., Benbecula).

Case Example 2 Energy, Health and Population in South Africa

Most of South Africa's commercial energy (83%) comes from coal. Energy prices, especially for big consumers, have been kept artificially low, thus providing no incentive for conservation or demand side management. Practically all environmental costs are externalized... People living near the largest coal-fired generating plants at Witbank, or the Pretoria-Witswatersrand-Vereeniging complex in Trasval,...suffer from disproportionally high respiratory impairment. Particulates SOx, NOx, volatile organics and CO...now cause major health impairment, such as bronchitis and cancers, especially in the townships and homelands. Acute respiratory infections are a leading cause of child mortality, especially in Witswatersrand. Source: Goodland, 1995, 13.

Although to date it has emphasized minimizing adverse effects, EA could also be used to maximize the beneficial effects of development on health. For example, EAs could identify strategies and measures that will actively promote health (e.g., workplace programs on health). Indeed, it has been suggested that EAs should consider how projects can promote health by conducting 'health opportunity assessments' (Slooff, 1995).

Public opinion surveys have shown that a high proportion of respondents feel that their health has been affected by pollution. In Russia, 89% of the people surveyed stated that their health had been affected a "great deal" or a "fair amount". The equivalent percentages for Germany, the U.S., Canada and India are 72%, 67%, 51% and 74%.

(Synergistics, 1993)

Address Public Concerns

Public concerns about development projects are frequently related to health, well-being and the quality of life. In industrialized countries many people feel that their health, or the health of their children, has already been harmed by pollutants. Local opposition to siting of hazardous facilities is often motivated by perceived risks to individual health, community well being and residents' safety. EA can provide a useful means of addressing these issues, especially where the process provides opportunities for the public to gain relevant information and to express their concerns (see Case Example 3).

Case Example 3 Quality of Life Impact of Aluminum Smelter Project, Laterriere, Quebec, Canada

The project was constructed in 1989 adjacent to the village of Laterriere (pop. 5,000) in the Saguenay-Lac-Saint-Jean region of Quebec. An ex-post study of the environmental and social impacts of development was compared to the proponent's EIS. Unforeseen effects as identified by local residents were compared to impacts as predicted. With respect to quality of life, nuisance, noise and health (contamination) effects were predicted to be negligible. However, residents' perceptions of the actual impacts were substantially different. They included the following aspects that detracted from their sense of well being (i.e., health in the broadest sense):

- excessive noise from smelting ventilators
- intense night time illumination
- unpleasant odours under certain conditions
- feelings of loss of community

Source: Gagnon, 1995.

Health professionals can be especially helpful in understanding and working with the public because of their long-standing tradition of community involvement and because they are trusted members of society. A recent study demonstrated that the public trusts physicians as a source of health information much more than any other source (Slovic et al., 1995). This finding suggests that physicians and other health professionals could have an important role in communicating information on the health effects of development to the public as part of EA. Because the public often appears to demand zero involuntary risk along with the benefits of development, health professionals need to come up with better models of risk characterization and comparison (Carpenter, 1995).

Although including health in EA can assess the potential health effects of development, there are many significant health and environmental issues beyond the scope of conventional EA, such as the remediation of contaminated land, licensing and permitting processes and the incorporation of health into regional and use planning. These and other issues may require health impact assessment processes.

Minimize the Need for Separate Health Impact Assessments

Including health in EA minimizes the need for separate health impact assessment processes and allows the health effects of development projects and policies to be considered in an integrated manner at the same time as environmental and economic issues. The approach is fully consistent with the recommendations made in Agenda 21, notably in Chapter 8 which deals with integrated decision making. Furthermore, it would probably be very difficult to gain acceptance for new, institutionalized 'stand-alone' health impact assessment processes now, given the current economic and political climate in many industrialized and developing countries.

But there are several potential disadvantages of including health in EA. Most importantly, the health component of EA must respect established procedures and requirements, including limits on time, resources or assessment approaches.

Demonstrate Cost Effectiveness

Including health in EA can be a cost effective strategy. When adverse effects on health can be minimized or prevented from occurring, an additional burden on health care services associated with the project or policy is avoided. Recent studies have demonstrated that significant socio-economic costs are imposed by environmental damages and related health effects. Preventing adverse effects on health is also fully consistent with the traditions and principles of public health which has emphasized preventive health strategies for almost two centuries.

"Nearly every Bank project can strengthen and be strengthened by public health and safety measures, ... and even small components can contribute significantly to human well being".

(World Bank, 1991)

Although the costs of the health component of EA have not been examined, they are likely to be very small when compared with the eventual costs of curative and treatment services necessary to deal with effects on health. It is difficult to quantify the health effects prevented by EA (i.e., effects that did not occur) and any positive health outcomes in economic terms. However, it is now widely accepted that a strategy of "anticipate and prevent" is far more cost effective than one of "react and cure". Leading businesses, for example, have endorsed the application of both the precautionary and polluter-pays principles for the assessment and management of environmental and health effects (Willums and Goluke, 1992).

3. Current Situation

International Policy Context

In 1982, the World Health Assembly adopted a resolution which recommended that *"environmental health and health impact studies"* should be carried out and developed prior to the implementation of all major economic development projects, with a special emphasis on projects for global water resource development (World Health Assembly, 1982). The resolution also endorsed the involvement of the World Health Organization in the health component of EA. Since then, the World Health Organization's policy on *"environmental health impact analysis"* (EHIA) has had two main aims (Giroult, 1988):

- To strengthen health and safety considerations in EA; and
- To encourage member states to conduct such assessments for all major development projects.

The World Health Organization's principles for "environmental health impact analysis" are:

- *Health should be one of the fundamental considerations in the approval of projects, policies and plans;*
- *Greater consideration should be given to the health consequences of projects, policies and plans in EA;*
- *EA should provide the best factual information on the health consequences of projects, policies and plans; and*
- *Information on health impacts should be available to the public.*

(World Health Organization, 1987)

Other relevant international environmental and health policy initiatives include:

- The European Charter on Environment and Health, developed by the World Health Organization's Regional Office for Europe (World Health Organization, 1990);
- The report of the World Health Organization Commission on Health and Environment – Our Planet, Our Health (World Health Organization, 1992);
- The World Health Organization's Global Strategy for Health and Environment (World Health Organization, 1993); and
- The Pan American Charter on Health and Environment in Sustainable Development (Pan American Conference on Health and Environment in Sustainable Development, 1995).

Although none of these more recent initiatives discuss the role of health in EA, they all contain commitments to strengthen the links among health, the environment and development and promote the role of health and environmental considerations in economic decision-making.

Current Practice

Although EA has evolved into a widely-used process for assessing the adverse environmental effects of development projects, human health is often neglected or assessed inadequately. It has been estimated that between 90 and 95% of all EAs lack appropriate health and safety assessments and do not involve health expertise (Slooff, 1995). Experience in the USA indicates that, typically, health impacts and risks are given minimal attention; and even when this is not the case the resulting studies are not well integrated into the environmental impact statement (Arquiaga et al., 1994).

One of the conclusions of a WHO review of health and EA was that the priority of health considerations in EA is determined largely by EA practitioners.

(World Health Organization, 1987)

There are at least four key factors that determine whether or not health is included in an EA:

- The type and size of the project and its potential effects;
- Any requirements, principles or guidelines for including health;
- The capacity and willingness of EA practitioners to include health issues in EA; and
- Public concerns about the project's effects on health.

For example, EAs of large projects are more likely to include health than EAs of small projects. Similarly, EAs are more likely to include health when similar projects are known to have caused adverse health effects. Well-known examples include hazardous facilities and activities that expose nearby populations to toxic chemicals, pathogenic organisms or radiation (see Case Example 4). Legislative, regulatory or procedural requirements can also be an important factor broadening the scope of EA to include health. Lastly, any public concerns about a project's effects on health can be important, and so can the ability and willingness of health professionals, proponents and government regulators to respond.

Case Example 4 Assessing Contaminants of Concern – The ALPAC Project, Northern Alberta, Canada

Dioxins and furans constitute a family of 210 chemically related chlorinated organic compounds of varying toxicity. These compounds are highly persistent and accumulate in living tissue. Studies of short term exposure to several milligrams of a mixture of dioxins and furans indicate a variety of potential effects on skin, eyes and sensory functions. However, evidence of carcinogenic effects, while of increasing public concern (e.g. with respect to drinking water), is reported to be inconclusive and conflicting.

In 1990, a federal EA panel was established to review the ALPAC bleached kraft pulp and paper mill in Northern Alberta, Canada. It recommended that the proposal not proceed, pending further study of the risks and hazards to aquatic systems and downstream users of the Athabasca River. Of particular public concern was the environmental health effects of furans and dioxins. Existing loadings of these compounds from existing pulp mills discharged into the Athabasca River were reported to be in excess of national standards. The proposal was allowed to move ahead once the proponent undertook to introduce new cycle technology that significantly lowered the emission levels of organochlorines.

To date, the health component of EA has focussed largely on potential effects of projects on physical health, especially increased risks of mortality, morbidity and injuries. But there is increasing interest in incorporating other aspects of health within the scope of EA, including the social, community and psychological dimensions of health and well-being. This may

It would be difficult for governments and international agencies to define health solely in terms of physical health for EA, while at the same time endorsing the much broader definitions of the World Health Organization. Whether this concept is a viable, as opposed to ideal, objective for health related EA's remains open to question.

be partly because many governments and international agencies have endorsed the World Health Organization's definitions of health and accept that health is much more than the absence of disease. In a number of continents, provision for social impact assessment (SIA) also affords an "entry point" for taking account of health considerations as part of the EA process. For example, Western Australian experience in the area is described by Beckwith (1994) (see also Case Example 5).

Case Example 5 SIA and Health Related Issues in Western Australia

"The last four years have seen a steady improvement in the standard of social impact assessment in Western Australia...[especially for] such as dust, noise, odor, air emissions, risk, visual amenity in buffer zones. For these types of social impact issues, the EPA [Environment Protection Authority]... has on occasion made very strong recommendations. In 1992, for example, the EPA concluded that the proposed Murrayfield car park was environmentally unacceptable because it would generate unacceptable noise for nearby residents. And in the case of the proposed expansion of the Premier coal mine at Collie, the EPA concluded that in these areas where residents' amenity would be unacceptably diminished by...potential noise impacts, the proponent would either have to relocate...residents or modify the mining operation to reduce the impacts to acceptable levels.

When it comes to social impact issues, such as work force impacts, lifestyle impacts and socio-economic impacts (e.g. property values), however, the EPA has demonstrated through its recommendations (or lack thereof) a low level of conflict with these issues...In the case of projects in remote areas of the state, the source of the project workforce will always be one of the major, if not the major social impact issue. [Also]...loss of rural character and property values to the community...are among the social impact issues of greatest concern to local residents."

Source: Beckwith, 1994.

Health issues have not yet been included in the strategic environmental assessment (SEA) of policies, programs and plans in a substantive way, although there is little doubt that development policies have major effects on health (Cooper Weil et al., 1990). SEA is still at a formative stage of process development, comparable to project EIA in the late seventies (see Sadler and Verheem, 1996). Public policy to achieve 'health for all' has yet to be translated into institutionalized processes that systematically address health issues at the policy, program and plan levels of decision-making. More positively, SEA and equivalent processes of policy appraisal and plan evaluation have incorporated health aspects (see Case Example 6).

Case Example 6 **Programmatic Environmental Impact Statement for Long Term Waste Management Strategy, USA**

In 1995, the US Department of Energy released a Programmatic EIS on alternative strategies for clean up of its existing storage sites. Six waste streams or categories were examined in relation to management and restoration scenarios, including the no action alternative (baseline risk assessment). A "strategic impact and risk assessment" (primarily qualitative and descriptive) was undertaken for each option. Alternative health considerations were central to the analysis, which included identification of occupational and transportation risks and the residual cumulative risk to the public associated with industrial, hazardous and radioactive wastes. Methods and applications followed the guidelines established by the US Environment Protection Agency. The uncertainties associated with estimating health and ecological risks were factored into the evaluation of alternatives and taken into account in the proposed strategy.

Requirements, Principles and Guidelines

Despite the fact that development projects can have profound effects on human health and well-being, relatively few international agencies or countries have requirements, principles or guidelines for health to be considered as part of EA.

A few international agencies, including the World Health Organization, the World Bank, the European Union and the UN Economic Commission for Europe have requirements or principles for the potential health effects of projects to be considered as part of EA. For example, the World Bank's Operational Directive on EA states that *"...EA covers... project impacts on health, cultural property and tribal people, and the environmental impact of project-induced resettlement".* Similarly, the European Union has developed environment and health principles for public policy that deal with EA (see Appendix B).

The Canadian Environmental Assessment Act (1992) defines an "environmental effect" as "any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions..."

Some countries have legislative requirements on including health in EA. But even where there are such requirements, the scope of the health effects to be assessed is rarely stated and the term 'health' is not defined. Sometimes, human health is included as one of the types of environmental effects to be addressed. In other cases, requirements to address health are linked with requirements to consider social and cultural effects, consistent with the World Health Organization's broad definition of health. For example, the UN ECE Convention on Environmental Impact Assessment in a Transboundary Context (1991) defines an impact as *"any effect ...on the environment including human health and safety, flora, fauna, soil, air, water, climate, landscape and historical monuments or other physical structures or the interaction among these factors; it also includes effects on cultural heritage or socio-economic conditions resulting from alteration to these factors".*

Beyond these general requirements, there is relatively little guidance material available. For an overview, see Roe et al. (1995). Considerable work in this area has been done by the World Health Organization Regional Office for Europe. This includes the development of a nine-step process for integrating health in EA (Giroult, 1988). The steps to be taken and the tools used in the conduct of what is referred to as EHIA are outlined in Table I, together with a summary of limits and constraints on their application.

At the international level, the World Health Organization has published a series of guidelines and recommendations on the 'Environmental Health Impact Assessment' (EHIA). Basic reference documents include a proposed methodology for rapid assessment of pollution impacts (Wito, 1982) and a handbook for practitioners (Turnbull, 1992). Sectional guidelines based on EHIA procedures outlined in Table I have been prepared for urban development projects (World Health Organization, 1985), the incorporation of health safeguards in the use of wastewater in agriculture (WHO, 1989), and in site selection for hazardous waste facilities (Sloan, 1993). Related guidelines for the incorporation of health safeguards into irrigation and other water resource development projects have been developed by the Joint WHO/FAO/UNEP/UNCHS Panel of Experts on Environmental Management for vector control (PEEM) (Tiffen, 1989; Birley, 1991). Both of these documents emphasize vector-borne diseases, such as malaria and schistosomiasis.

The World Bank has also prepared several manuals and technical reports on environmental health impacts and methods for taking these into account in the project development cycle (e.g. Lostorti, 1990). Volume II of the Bank's Environmental Assessment Sourcebook contains sectional guidelines for addressing public health and safety issues, which recognize that "Bank projects are in a position to make a significant contribution toward eradicating major diseases of developing countries". In this regard, specific reference is made to the role of women in ensuring health improvements.

More recently, the Commonwealth Secretariat established an Expert Group on Health Assessment as Part of Environmental Assessment that has developed a framework which specifies the role of health expertise in EA and provides guidance on health assessment activities at different stages of an EA as well as the types and sources of information and skills required (Slooff, 1995).

Guidance material on EHIA of development projects has also been prepared for the Asia-Pacific region by the Asian Development Bank (Birley and Peralta, 1992).

As well as proposing a framework, Ewan et al. (1993) discuss the key conceptual, procedural and methodological issues associated with including health in EA.

To date, few countries have prepared guidance on the health component of EA. In Australia, the University at Wollongong has published a draft 'National Framework for Environmental and Health Impact Assessment' which is based on seven steps, including screening, scoping, profiling, risk assessment, risk management, decision-making and implementation and monitoring, auditing and evaluation (Ewan et al., 1993). This framework reflects key principles of public health; namely:

- Human health and the environment are interdependent.

TABLE 1 **Proposed Environmental Health Impact Assessment Process**
(Giroult, 1988; Martin, 1986)

Steps to be Taken	Tools to be Used	Limits and Constraints on Application
Step 1 Assessment of primary impacts on environmental parameters	Regular EA process (modified where necessary to include health relevant methods and procedures	1. Complex nature of environmental health impacts e.g., • impact often non-specific or probabilistic • many indirect effects • interaction among factors
Step 2 Assessment of secondary or tertiary impacts on environmental parameters resulting from primary ones	Regular EA process	
Step 3 Screening of impacted environmental parameters of recognized health significance (environmental health factors)	Epidemiological knowledge	2. Limits of scientific knowledge and methology, e.g. level of • understanding of chemical toxicity and environmental disease • difficulties of "control" of exposure pathways and risk groups
Step 4 Assessment of the magnitude of exposed population for each group of environmental health factors	Census, land use planning	
Step 5 Assessment of the magnitude or risk groups included in each group of exposed population	Census, other population data	3. Biological variation in response • affects both epidemiological and experimental approaches • e.g. extrapolating dose-response relationships to susceptible sub-groups
Step 6 Computation of health impacts in terms of morbidity and mortality	Results from risk assessment studies	
Step 7 Definition of acceptable risks (or of significant health impacts)	Assessment of trade-offs between human and economic requirements	4. Resource constituents, e.g. related to: • baseline data assembly and comparability • specialized training • communication of risk
Step 8 Identification of efficient mitigation measures to reduce significant health impacts	Abatement of environmental health factors' magnitude, reduction of exposure, reduction of exposed populations, protection of risk groups	
Step 9 Final decision	Significant criteria, mitigability of impacts	

- Environments are likely over time to affect human health for good or ill.
- Human health is affected by social, psychological, economic, ecological and physical factors.
- Human health is a basic requirement for, and imperative of, ecologically sustainable development.
- Decision-makers have a responsibility to involve communities in decisions which affect the health and amenity of their environment.
- Social justice is a key consideration in public health policy and ecologically sustainable development.
- Decisions should err on the side of caution when impacts on health and the environment are not clearly understood.

Canada is developing a Canadian guide on health and EA, based on comments and suggestions made at a series of six regional workshops attended by a total of about 200 people and the results of a questionnaire on the role of health professionals in EA completed by more than 100 people.

New Zealand has also published a 'Guide to Health Impact Assessment' (1994), which describes the country's regulatory framework for including health in EA, as well as procedures and methods for public participation. The US Council on Environmental Quality (CEQ) has prepared a comprehensive guide to principles and methods for Analyzing Health and Environmental Risks (Cohrssen and Covello, 1989). Designed for users of risk analysis, the guide provides an introduction to the technical and non-technical literature, encompassing five interrelated phases of hazard identification, risk assessment, determination of significance and risk communication.

As noted earlier, requirements, principles and guidelines are a key factor in determining whether or not health is included in EA and the shortage of these materials partly explains why so few EAs address health issues. The shortage of requirements, principles and guidelines also means that:

- There are few administrative imperatives for including health in EA and no penalties for not including health in EA;
- The inclusion of health in EA is done almost entirely on an ad hoc basis, depending on moral suasion, the willingness of EA practitioners and public concern;
- There is little agreement on the scope of the health issues that should be addressed; and
- There is little consistency in the approaches and procedures being used.

4. Including Health in EA

Although EA requirements and processes vary around the world, there are some common, though not universal, procedural elements including:

- Screening the project to determine whether or not an EA is required;
- Scoping or identifying the issues to be considered in the EA;
- Assessing the potential effects;
- Consulting the public about their concerns;
- Determining the significance or importance of the effects; and
- Implementing mitigation measures and follow-up activities.

These elements are not necessarily chronologically or methodologically distinct and are often combined or complementary. In particular, public consultation is a process that extends throughout EA. While its emphasis varies, it is not a stage of EA per se. For convenience, however, the role of health in each one is briefly outlined below.

Screening

Question to consider:

- *If an EA is required for the project, should health be included?*
- *Is the project likely to present health concerns, based on current knowledge and experience?*

The purpose of screening is to identify which projects are likely to have important effects and should be subject to EA. All screening procedures should consider the need to assess a project's potential effects on health, even though it may not always be necessary to include this consideration in the later stages of the EA. Unless health is considered during screening, it is unlikely that it will be addressed subsequently in an EA. Public consultation at other stages of an EA process also may lead to the identification of health issues and concerns.

"Health hazard identification is the primary screen. It is based on existing experience and the screening tools provided. The output is a...list of health hazards".

(Asian Development Bank, 1992, e. 3)

The World Health Organization has classified the different methods used for screening for potential health effects into four major categories (World Health Organization, 1983):

- Threshold criteria based on the size or cost of the project or its projected emissions;
- Siting criteria, such as the designation of sensitive areas, for example, an area's potential to disperse pollutants, the presence of disease vectors and health status;
- Inclusion and exclusion lists which identify the types of projects required to undergo EA, or those excluded from EA; and
- An initial environmental evaluation to determine the need for full consideration of health in EA.

In many cases, rapid assessment techniques, based on existing information on the environment and communities potentially affected by a project, may be used. WHO guidelines for the conduct of rapid assessments identify three main dimensions of a potential health hazard. These are:

- Community vulnerability – including general health status, previous history of exposure and presence of specific sub-groups at greater risk;
- Environmental receptivity – including ecological, physical and/or climatic factors that influence exposure to harmful substances; and
- Quality of health services – including resources to monitor and respond to increased health hazards. The under supply of health infrastructure in developing countries and remote regions of industrialized countries (e.g. Northern Canada) may increase any health risks identified.

"Health input (in screening) is important, although it is frequently omitted at this stage unless policies and legislation require mandatory consultation with health authorities for designated development".

(Ewan et al., 1993)

Selected types of projects most likely to cause health effects and thus requiring health assessment include:

- Infrastructure and urban development including road and rail, utilities, bridges, airports, etc.
- Mining, smelting and metal processing;
- Energy production, including nuclear, coal, oil and gas and hydro-electric;
- Agricultural and irrigation;
- Production and manufacturing processes that use chemicals;
- Natural resource management, including forestry, pulp and paper, fisheries, etc.; and
- Waste management, including sewage treatment and hazardous and non-hazardous wastes.

Screening tools, such as matrices, checklists and threshold criteria, should be reviewed to see if they adequately address the health effects associated with various types and classes of projects.

At present, screening is usually done by EA practitioners who may not have a thorough understanding of health issues. As a result, health concerns may not be identified at all or only when it is too late to conduct a thorough health assessment. Furthermore, if health concerns are raised for the first time during public consultation, they are often raised in an adversarial manner and can be used to polarize debate about the project's potential effects. For these reasons, it is important to include health professionals in screening, so that they can provide advice on whether or not health issues should be included in an EA.

Scoping

Questions to consider:

- *What health issues should be addressed in the EA?*
- *How should they be addressed and in what depth?*
- *Who should be involved in the health assessment?*

The purpose of scoping is to identify the effects that should be addressed in an EA. By definition, scoping is a process of prioritizing, reducing a long list of possible issues to a short list of potentially significant ones. This exercise should include any health issues to be assessed. It usually results in the preparation of terms of reference for the scope of the assessment, the methods to be used and the roles and responsibilities.

The types of health effects identified during scoping will vary enormously depending on the size and nature of the project, the health of the potentially affected communities and the social, economic and cultural context. Aspects of health that have been considered in EA are shown in Table 2.

"The identification of a hazard short list is part of the scoping process".

(Asian Development Bank, 1992)

The identification and assessment of cumulative effects is an emerging issue for the health component of EA. A few countries now require the assessment of a project's cumulative effects as part of EA and it can be argued that many health effects associated with development are cumulative. For example, the construction of high-rise apartment buildings for public housing in North America in the 1960s and the more recent spread of low-density housing development have both had profound effects on health and the quality of life.

Like screening, it is critical for health professionals to be involved in scoping if health issues are to be adequately addressed in later stages of the EA. Indeed, Go (1987) has suggested that *"participation by health authorities during this phase of the EIA process is the key to ensuring that human health and welfare effects are given full weight in subsequent planning activities".* As a general rule, a health-impact focus should be included in the EA process if the answer to any of the following questions is yes (Canter, 1995):

1. "Does the...proposed project (or activity) involve the handling of emissions to the environment of materials such that their physical, chemical, radiological or biological nature may be harmful to human health?
2. Is the location of the proposed project...likely to give rise to conditions that would alter the occurrence of natural hazards in the study area? and
3. Could the implementation of the proposed action eventually give rise to conditions that would reduce or increase the number of adverse health-impact-causing factors?"

TABLE 2 Features of Health Considered in EA

Feature	Characteristics
Hazardous agents	Microbiological virus-bacteria Chemical – heavy metals and organic chemicals Physical – noise, dust, radiation, vibration
Environmental factors	Changes in the quality or availability of water, food, air, land and soil Waste management practices Physical safety and security Disease vectors
Exposure conditions	Human exposure pathways – food, air, water, etc. Public exposure Occupational exposure Identification of high-risk groups
Effects on physical health	Mortality Morbidity – communicable and non-communicable diseases, acute and chronic effects Injuries and accidents Effects on future generations Effects on high-risk groups Exacerbation of existing health conditions e.g., asthma Cumulative effects
Effects on health care services	Incremental health care needs Displacement of traditional health care services
Other effects on health	Effects on income, socio-economic status and employment Effects on municipal revenues and local industries Migration and re-settlement Effects on social and community health including effects on culture and way of life Effects on services e.g., education, social support networks, etc. Effects on psychological well-being e.g., stress, anxiety, nuisance, discomfort Beneficial effects on health

Assessment

Questions to consider:

- *Which populations, groups or communities are likely to be affected by the project?*
- *What is the current health status of the potentially affected populations, groups or communities?*
- *What are the project's likely effects on health and well-being?*

The assessment phase lies at the heart of EA, however, before a project's potential effects on health can be assessed, it is important to identify the populations likely to be affected and to determine their baseline health status. In this context, it should be noted that the health component of EA is usually applied at a ***population*** level. Accordingly, the health component of EA should identify potentially affected groups and communities, including workers, the public and any sensitive sub-groups such as indigenous people, children, the elderly, pregnant women, etc. Then, baseline information relevant to health status can be collected and synthesized.

The concept of Total Human Exposure (THE) affords a composite approach to assessing health risks. It is based upon a "bubble" model for exposed populations, in which pollutant concentrations in food eaten, air breathed, water drunk and skin contacted are estimated.

(Ott, 1990)

The World Health Organization has identified two types of baseline information relevant to health (World Health Organization, 1985):

- Information about the existing environment, used to determine *"environmental health factors"* within an area (e.g., current levels of pollution, transmission pathways for existing disease problems); and
- Information on human health, behaviour and exposure to health hazards is needed to identify the pathways by which people are exposed to environmental health determinants. This includes the size, location and characteristics of the existing and incoming populations, particularly the degree of contact with environmental health determinants, and current health problems, including prevalent diseases and immunities in both the local population and incoming settlers.

In a WHO review of thirteen EAs completed between 1973 and 1982, eleven were found to contain few baseline data appropriate for health impact assessment.

(Giroult, 1988)

In practice, EAs rarely include baseline data of either type. Not surprisingly, when relevant baseline data are included, it is a summary of existing, available information. New health information is very occasionally collected for EAs of large projects when there are large data gaps or the available information is ambiguous, but this is unusual. There are, however, several problems associated with relying on the available health information, including:

- Health information is usually collected for specific purposes and can be difficult to modify or adapt for use in EA. For example, most medical data are difficult to use in EA because information is collected for physician billing, insurance and health care planning and utilization studies. Thus, it rarely distinguishes between new cases of a health problem and repeat visits for the same condition.

The US Environmental Protection Agency has established an on-line integrated risk information system (IRIS) that summarizes data on exposure-health relationships for several hundred chemicals.

- Although most countries have national health statistics, there is often a shortage of information on health status and the determinants of health at a community level. In particular, there is a shortage of information on morbidity, psychological well-being and social and community health; and
- Health information is rarely related to environmental quality. Although the biophysical environment is a determinant of health, the study of precisely how the environment affects health is still in its infancy. Environmental and occupational epidemiology are evolving rapidly, but there is a need to further improve understanding about how environmental conditions affect trends and patterns in health.

Once the baseline health status has been determined, it is possible to assess a project's potential effects. The general approaches that are used to assess a project's potential effects on health include:

- Literature reviews;
- Case studies of effects associated with other similar projects;
- Site visits; and
- Expert knowledge and experience.

These approaches are complementary and are often used concurrently. For example, expert knowledge is an essential ingredient of all health assessments. Sometimes more formal methods are used. The main types of methods and their relative strengths and weaknesses are summarized in Table 3.

As an aid to health impact prediction and interpretation, two tasks can be helpful:

- *Classification of potential impacts (e.g., adverse/beneficial, short term/long term, direct/indirect); and*
- *Identification of scenarios or circumstances for potential health effects (e.g. routine operations v. accidental events, including the "worst case" scenario.*

(Arquiaga et al., 1994)

"The primary objective of risk assessment is to estimate the likelihood (or probability) and the severity of harm to human health and the environment occurring from exposure to a risk agent. Analytical procedures used to generate a risk estimate include:

- *Source/release assessment;*
- *Exposure assessment;*
- *Dose-response assessment; and*
- *Risk characterization."*

(Cohrssen and Covello, 1989)

EAs of projects that involve chemicals or ionizing radiation often use risk assessment methods as a means of assessing any potential effects on health. Over the last 20 years, quantitative risk assessment methods have been developed and used extensively in Canada, the U.S. and other countries for a variety of purposes including establishing risk-based environmental priorities and strategies, setting environmental and health guidelines, and in EA. Within the context of EA, risk assessment usually involves considering the toxicity of the agent(s) being used or produced, the exposures and/or doses received by the affected population(s) and the consequent risks of adverse health effects. It can include quantitative toxicological information derived from studies on laboratory animals, analyses of human exposure pathways, the identification of high-risk populations and mathematical modeling of the relationship between exposure or dose and the probability (i.e., risk) of specific health effects.

TABLE 3 Methods for Assessing Health Effects

Types of Method	Characteristics	Strengths	Weaknesses
Matrices	Rows usually correspond to different project activities and stages, and columns correspond to different aspects of health	• Simple • Can be adapted to different types of projects and effects • Can be modified to include weighting or ranking systems	• Do not represent spatial or temporal considerations well • Tend to oversimplify interactions • Do not address the magnitude of the effects unless weighting or ranking systems are included • Can be cumbersome if there are many rows and columns
Mapping (including GIS)	Can be used to assess changes in the spatial distribution and extent of effects using point or polygon data. Map overlays can assess the relationships between the project and health risk areas. GISs permit more sophisticated analyses.	• Represents spatial considerations well • Can be adapted to temporal considerations by doing a time series analysis • Can incorporate effects from single or multiple sources	• Does not identify cause and effect relationships well • Requires a lot of spatial data • Can be expensive in terms of time and resources to generate useful information
Risk Assessment	Predicts the quantitative risk of health effects, most often cancer, associated with exposure to individual hazardous agents. Risk assessment methods are used extensively in industrialized countries.	• Good at relating causes and effects and determining probability functions • Scientifically accepted	• Does not represent spatial considerations • Only possible for some health effects, chemicals and ionizing radiation • Difficult to validate

TABLE 3 Methods for Assessing Health Effects (continued)

Types of Method	Characteristics	Strengths	Weaknesses
Surveys and Questionnaires	Usually consist of standardized questions administered by telephone, mail or in person to a selected sample. Results are statistically analyzed.	• Useful for obtaining baseline health information • Can be used to collect information on public concerns • Can involve potentially affected people	• Can be expensive in terms of time and resources • Large, random samples are needed for representative results • Investigators can bias the results • Response rate is important • Control groups may be needed
Network Analysis and Flow Diagrams	Used to construct illustrative figures relating project activities and stages to primary, secondary and tertiary effects.	• Simple and inexpensive • Good at relating causes and effects	• Does not represent spatial or temporal considerations well • Do not address the magnitude of the effects well • Can become very complicated and cumbersome
Group Methods	Groups of selected people discuss particular issues or questions. Questions are usually more open-ended than survey questions. Focus groups are a frequently used method.	• Can be used to determine baseline conditions or predict effects • Can involve potentially affected people • Can lead to consensus and balance out opposing views	• Can require considerable time commitment from participants • May not be representative of the population at large • Investigators can easily bias the results
Expert Methods	Relies on the use of experts, either individually or in groups. Examples include Delphi and nominal group techniques.	• Uses professional knowledge and experience • Can be effective when time or resources are limited • Can lead to consensus and balance out opposing views	• Results depending on the experts selected

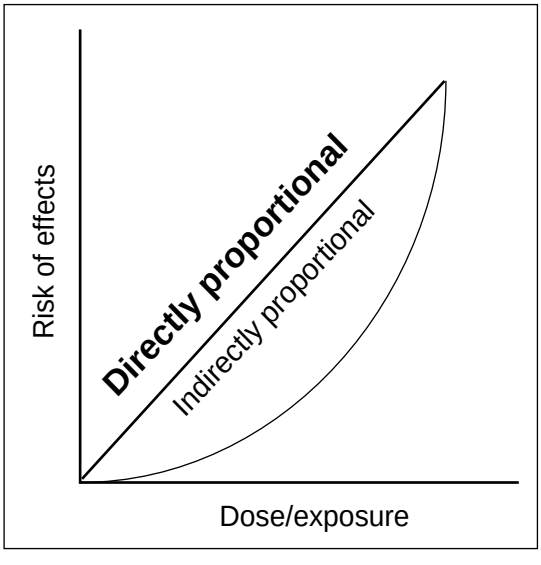
According to Callahan (1989), there are three main approaches to determine dose-exposure relationships:

- *Direct measurements via monitoring;*
- *Use of tissue levels or biomarkers; and*
- *Predictive estimates, based on experimental results, models etc. as widely applied in EA.*

Risk assessment can be very helpful in EA especially to recognize and address potential consequences that are uncertain (but which have a known probability of occurrence). Various approaches have been proposed for integrating risk assessment into the EA process (e.g., Canter, 1993). A methodology that incorporates specific health-related factors is outlined by Arquiaga *et al.* (1994). The technical core is focussed on impact prediction via the use of exposure assessment, dose-response assessment (including justification of extrapolation methods) and health impact characterization (including explicit reference to statistical and biological uncertainties).

Health effects risk assessment also has limitations, including:

- Risk assessment is usually based on a substance-by-substance approach that cannot easily take account of exposure to mixtures, and most people are exposed to mixtures (as in the THE concept described previously);
- Information on the toxicological characteristics of individual substances and agents is often incomplete. For example, a 1984 study found that there is insufficient information to conduct a comprehensive health risk assessment on the vast majority of chemicals in common use in North America (U.S. National Research Council, 1984).
- Values and assumptions can influence the outcome of risk assessment significantly. For example, it is accepted that many carcinogenic chemicals and ionizing radiation do not have thresholds of action, below which there is no risk of adverse effects occurring. In other words, the risk of effects is directly proportional to the exposure (see figure). By contrast, other responses change environmentally with the level of exposure (non-linear response). To decide on an allowable dose or exposure, it is therefore necessary to decide on an 'acceptable level' of incremental risk. This is often controversial, or involving trade-offs between human health costs and development benefits; and
- Risk assessment methods have only been developed for a few types of effects on physical health, most notably cancer and acute effects. They cannot be used to address all types of physical health effects or effects on social, psychological and community health and well-being.



In ecological terms, there is... "no equivalent of the lifetime consumer-risk estimate used in health risk assessment. The ecological risks of interest differ qualitatively between different stresses, ecosystem types and locations".

(US National Research Council, 1993)

Finally, it is worth noting the increasing use of ecological risk assessments in the US, and to a lesser degree other countries. This process differs from public health risk assessment in several important ways (see side bar). No widely applicable procedures for ecological risk assessment are yet available. Instead, a combination of approaches are used, including traditional reductionist methods to identify how individual species and biological communities are affected by stressors (see Carpenter, 1995). These could also form part of strategic integrated assessments to take account of cumulative effects and their health implications, characterized as possible pathologies of global change.

Public Consultation

Questions to consider:

- *Are there any public concerns about the project's effects on health and well-being?*
- *If so, how can they be addressed effectively?*
- *What mechanisms for public consultation best allow for effective representation of views and information?*

In recent years there has been a trend toward increasing public consultation in EA. Many countries and international agencies now have formal requirements for public consultation as part of their EA processes. Concerns about a project's adverse effects on health and well-being are often raised during public consultation, especially if these issues have not been addressed earlier in the EA process. In fact, the issues most often raised in public consultation are related to health, well-being and the quality of life.

Public consultation performs three key purposes:

- *Expression of concerns and interests;*
- *Source of information and data on potential effects; and*
- *Builds credibility of EA.*

Public concerns about a project's effects on health and well-being can be quite different from scientifically determined health risks and these differences can be a source of problems in EA. Often, there are public perceptions that a project will be associated with adverse effects on health, while a scientific health assessment will conclude that there are unlikely to be any significant effects. This can lead to an adversarial situation in which the public ends up feeling frustrated, alienated and disempowered.

This type of situation can be avoided or at least minimized by taking a systematic approach to public consultation. With health-related issues, this will include implementing long-term risk communication strategies to inform and educate people about how the environment can affect health and by involving potentially affected communities in decision-making at the local level, whenever possible. These strategies are fully consistent

Leading U.S. experts on risk communication have argued that "those who assess and manage risks need to relate to their constituents over the long term in ways that establish trust, credibility and mutual respect" (Slovic et al...1990). In 1993, Slovic went further to assert that "trust is more fundamental than risk communication".

(Slovic, 1993)

with documents such as the Ottawa Chapter on Health Promotion (World Health Organization, 1986) and with initiatives to decentralize responsibility for health and environmental protection to the local level, such as the Healthy Cities Project. However, they go well beyond the scope of an individual EA and require health and environmental professionals to work at a community level on an ongoing basis that builds long term trust and acceptance.

Within the context of EA, early and ongoing public consultation is vital, especially for projects that have potential health-related effects. However, the role of consultation in the EA should be clear to all participants from the outset. Otherwise, they may have unrealistic expectations about the process and its outcomes. A range of methods and techniques for public consultation are available and many agencies provide guidance on good practice (e.g., the Canadian Environmental Assessment Agency). Key attributes of effective public consultation include access to resources, especially expertise, information and funds to retain experts and cover expenses.

Public consultation strategies need to be adopted to the circumstances and capacities of the people involved. Special care needs to be taken in addressing the concerns of indigenous people and minority groups.

As well as providing a means of addressing health concerns, public participation in EA and other planning and decision-making processes may actually promote health. Research indicates that the degree of control that people have over their lives and their discretion to act are important influences on health and well-being (Advisory Committee on Population Health, 1994). Initiatives such as the World Health Organization's Healthy Cities Project are effective not only because they have successfully addressed significant issues related to the environment and health, but also because they promote health by empowering individuals and communities to take more control of their health and local environments.

Determining Significance

Questions to consider:

- *Is the project likely to cause any adverse effects on health and well-being?*
- *If so, are the effects justified?*

When health is included in EA, it is common practice to provide advice on the significance or importance of any effects to the decision-makers so that they can weigh a project's beneficial effects against any adverse ones, before deciding whether or not the project should be allowed to proceed. In many cases, the formal determination of significance is made for residual impacts, i.e., adverse effects that cannot be mitigated. This is the process followed in Canada, for example. However, in practice, evaluations of significance occur at all stages of the EA process, beginning with screening and scoping.

One approach used to provide advice on the significance of potential adverse health effects is health-based environmental standards, guidelines and objectives. Such regulating "thresholds" have been

developed by many national and international agencies for environmental and occupational hazards, including noise, contaminants, radiation and microbiological agents. If the levels predicted in the health assessment are less than the standards, guidelines or objectives, then it is assumed that there will not be any effects or that they will be insignificant.

In 1983, the World Health Organization introduced guidelines for drinking water quality and in 1987 air quality guidelines were published. The air quality guidelines address 32 different parameters and there are plans to establish guidelines for an additional six.

But although health-based guidelines and objectives provide a straightforward means of determining significance, they should be used cautiously. Most guidelines and objectives are set to protect against specific types of health effects only, most commonly acute effects and cancer. Thus, compliance may not guarantee protection from all types of adverse health effects. As well, guidelines and objectives are usually set for individual hazardous agents, but as noted above people are often exposed to mixtures. Furthermore, health-based guidelines and objectives have not been developed for all environmental hazards and they do not address the social, community or psychological dimensions of health and well-being effectively. The development of significance criteria and indications in these areas is a critical requirement.

The Enquete Commission of the German Bundestag (1994) makes an important distinction between risk perception and risk acceptance. In determining the latter, risk-benefit analysis can provide important information and is widely used in regulating pesticides and insecticides.

When there are no relevant health-based guidelines and objectives that can be used, advice to decision-makers on the significance or importance of any effects on health and well-being is usually based on factors such as:

- The magnitude or severity of the potential health effects;
- The number of people potentially affected;
- The size and nature of the potentially affected population(s) (e.g., workers, children, the elderly, etc.);
- The frequency or duration of the potential health effects;
- The degree to which the health effects are reversible or irreversible;
- The probability or likelihood that the health effects will occur; and
- The level of uncertainty inherent in the health assessment.

Questions to consider:

- *How can any significant adverse effects on health be mitigated?*
- *Is there a need for any follow-up activities to ensure that health and well-being are adequately protected and/or enhanced?*

Mitigation and Follow-up

Most EAs that include health identify measures to mitigate or eliminate any adverse effects. The World Health Organization (1985) has identified three main categories of mitigation measures for health effects:

- Mitigation through control of sources (e.g., pollution standards, safety standards);

- Mitigation through control of exposure (e.g., planning requirements, public health measures); and
- Mitigation through health service development (e.g., health education, provision of medical services).

Ideally compensation is a means of managing social impacts. Ideally, it should be used in addition to, rather than instead of, other mitigation measures. It can be helpful to:

- *Offset special impacts, such as a loss of property values;*
- *Avoid litigation;*
- *Redress inequities in siting of facilities which are seen as necessary for the public good; and*
- *Address residual impacts.*

(Beckwith, 1991)

Providing compensation or restitution is an additional option, but although compensation for some types of health effects, such as those on social well-being and the quality of life, may be appropriate, providing compensation for adverse effects on physical health or for facing increased risks (e.g., 'danger pay' for workers) is a much more difficult issue.

The choice of mitigation measures will depend on a variety of factors including the size and nature of the project and its effects as well as local environmental, social, cultural, political and economic conditions. Most importantly, mitigation measures for effects on health should be designed to suit local circumstances and be acceptable to the potentially affected population(s). Although all four types of measures can be effective, they can be seen as forming a hierarchy. In general, it is better to mitigate any health effects by controlling the sources of harm (e.g., pollution prevention strategies, the use of non-toxic alternatives, etc.) and compensation or restitution should be regarded as the 'mitigation measure of last resort'.

The majority (80%) of the respondents to an Australian survey on health and EA viewed current monitoring systems as inadequate to assess or protect community health.

(Ewan *et al.,* 1993)

It is important to ensure that any mitigation measures for potential effects on health recommended in an EA are implemented and monitored as to their effectiveness, and to verify that there are no unanticipated effects on health and well-being.To date, however, follow-up monitoring for health has not been a key feature of EA. Since mitigation measures for adverse effects on health can be applied at four different levels, follow-up monitoring for health may be appropriate at any of these levels. When designing a follow-up monitoring program, it is important to clarify the details of the program, as well as the roles and responsibilities of different agencies and individuals. In addition to follow-up monitoring, review and evaluation are important tools to learn from experience. They can lead to improvements in the capacity to assess a project's effects on health.

For long term health effects, monitoring can be used to document the impacts that result from a project and to review the effectiveness of impact prediction and mitigation techniques. For short term health effects, monitoring can also serve as a possible warning system.

(Canter, 1995)

5. Priorities and Needs...Toward an Agenda for Action

A recent survey of Canadian health professionals, EA practitioners and others found that 79% of the respondents felt that the emphasis on health in EA should be increased.

(Praxis, 1996)

Key Priorities

The two most important priorities are to strengthen the role of health considerations in EA and to ensure that the scope of the health issues addressed is consistent with, and takes account of, currently-accepted definitions of health and the known determinants of health.

- ***Strengthening the role of health in EA:*** This will allow the benefits outlined in section 2 to be realized. However, the health component of EA should not impose an unreasonable burden on proponents and others. In the present economic climate, it is unlikely that new resources (people or funding) will be made available and any strengthening of the role of health in EA will probably have to be done by re-focussing priorities and reallocating existing resources. The necessity to do more with less likely will conflict to some degree with the next priority.

At the recent Canadian Workshops on health and EA, there was a consensus that the health component should include the 'socio-cultural' dimensions of health and that indicators, methods and procedures are urgently needed to assess these types of effects on health and well-being.

(Health Impact Assessment Taskforce, 1996)

- ***Broadened scope:*** EA should be broadened to reflect currently-accepted definitions of health, such as the World Health Organization's, and the known determinants of health. In practice, this will mean assessing a project's effects on community, social and psychological health and well-being, and not limiting consideration to effects on physical health. 'Social impact assessment' (SIA) is a reasonably well-developed component of EA with established approaches and measures that could be linked to health. Although SIA has not yet been effectively related to health and well-being, it represents an opportunity for addressing health and well-being factors in a broader context.

Supporting Requirements

There are also several subsidiary priorities which, if acted upon, could assist in achieving the two main priorities discussed above.

A framework of guidelines and principles for implementing SIA has been prepared by the Inter-Organizational Committee (1994). The SIA model covers 5 major categories: population characteristics, community and institutional structure, practical and social resources, individual and family changes, and community resources.

Increasing Awareness

There is a need to increase awareness of the role of health in EA and to promote its benefits. The World Health Organization has identified the following four objectives related to increasing awareness (World Health Organization, 1987):

- Inform health professionals (including public health doctors, toxicologists and epidemiologists) of the preventive opportunities offered by EA;
- Persuade decision-makers and EA practitioners (e.g., EA commissions) of the dangers of not considering health effects;
- Inform EA practitioners of the importance of health in EA; and
- Inform the public of the value of EA in maintaining and protecting health.

The Commission for Environmental Cooperation, established under the North American Free Trade Agreement, has established a number of priorities for action, including "reviewing risk of human health". A North American Pollution Release Inventory has been established, which will bring together existing national information about emissions and long range transportation of pollutants.

(Commission on Environmental Cooperation, 1995)

A variety of strategies can be used to increase awareness about health, EA and the environment including:

- The development of relevant training and education initiatives;
- The preparation of publications on health and EA, including guidance material, text books, case studies, handbooks, scientific papers, etc.;
- The use of the media, including electronic media, T.V. etc. to publicize and popularize information on health and EA and the health effects of development;
- The development and implementation of outreach and advocacy programs on health, the environment and EA by government agencies, professional associations, the voluntary sector and others.

In describing Australia's experience with health and EA, Ewan et al., (1993) stated that "...health agencies may either not be involved at all, or only towards the end of the process...In some cases, the degree of consultation appears to hinge on the personal relationships developed by staff in environmental agencies with their counterparts in health agencies".

Building Partnerships and Clarifying Roles

There is a need to ensure that health professionals become actively involved in EA. Mechanisms to facilitate collaboration and coordination between health professionals and EA practitioners could include involving health agency staff in EA screening and scoping committees, establishing formal agreements between health and environmental agencies, and joint initiatives on health and EA (e.g., preparing guidance material, training programs, staff secondments etc.). If the social, community and psychological dimensions of health and well-being are included in EA, it will also be necessary to build stronger partnerships between health professionals and social scientists. Skills in social science research and analysis will be needed to link 'social impact assessment' with the health component of EA.

Local medical health officers and public health workers can provide useful information on community health and public concerns, whereas government health professionals may have close links with regulators and decision-makers.

Since 1992, a consortium of universities from eight countries in the Amazon basin (UNAMAZ) has been working with the International Development and Research Centre and Health Canada to strengthen capacity to assess the potential health effects of development projects in the region. Universities in Brazil, Columbia and Venezuela have been focal points for this initiative.

Building partnerships also means that there is a need to clarify the roles and responsibilities of health professionals in all phases of EA so that their participation is timely and cost effective. Furthermore, information and advice provided by different health professionals should be consistent and clear. The role of health professionals in screening and scoping is especially important as recognized by Go (1987) in the following statement:

> *"The role of health authorities in the EIA process is primarily one of review and advocacy. This can only be effectively discharged when health agencies actively participate in the planning process by articulating human health concerns and ensuring the methodological procedures are adequate to capture significant projects and able to weigh their health implications."*

Strengthening Capacity

In the UK, the Institute of Chemical Engineers and the Institute of Environmental Assessment has prepared a 'Slide Training Package in Environmental Impact Assessment'. The 300 slide package provides a comprehensive introduction to the conduct of EA with specific reference to pollution control and waste management issues.

There is an evident need to strengthen the capacity to assess and mitigate the health effects of development projects, especially in the developing world as a result of globalization of trade and the development of manufacturing industries. Training and education programs as well as the development of policies, legislation, procedures, methods and indicators are urgently required. The Commonwealth Secretariat Expert Group on Health Assessment as Part of Environmental Assessment (Slooff, 1995) has argued that training on health and EA should be considered in the context of capacity building for sustainable development.

The Expert Group also described the key points that should be considered in the development of training programs:

- The context for the role of health in EA in individual countries, including the legislative framework and the awareness that health and environmental considerations should be included in decisions about development;
- There are training needs for information on health, the environment and EA and training needs to improve skills in understanding and handling the information;
- A range of target audiences require training including health professionals, EA practitioners, and the public;
- Training methods should be task-oriented, hands-on and on-the-job, rather than academic, abstract and theoretical; and
- There is a need for accessible, user-friendly core training material that could be used as a basis for a larger collection of teaching and learning materials.

"The continuing emphasis on linear cause and effect research in the scientific community should be changed to focus on understanding the complexity of the relationship between environmental stresses and human health. This will require a paradigm shift."

(Canadian Environmental Assessment Research Council, 1991)

Improving the Knowledge Base

To date, very little research and development work has been done on the health component of EA and most has focused on the procedural basis for including health in EA. In the future, research and development to improve the knowledge base used in the health component of EA should be more practical and applied, using real life case studies and examples, rather than being abstract and conceptual. The focus should be on translating concepts and principles into cost effective practice, rather than developing new frameworks or procedures. Priority areas include:

"There is a requirement for a consistent set of preliminary screening mechanisms which allow for a quick determination of the health implication of each project."

(Foster and Hardy, 1994)

- Defining indicators of health and well-being that can be used in EA, especially indicators of community, social and psychological health and well-being;
- Ensuring that there is baseline information available on health and environmental conditions at a community level, including data on physical, social, community and psychological health and well-being, and that these two types of information are related to each other;
- Developing methods and procedures, and especially
  - methods for assessing the potential effects of projects on social, community and psychological health and well-being
  - methods for use at a community level in small populations
  - methods for assessing the health benefits associated with development, especially improvements in health that can be attributed to economic status; and
- Ensuring that mitigation measures are effective and that projects do not cause any unanticipated effects on health, by implementing follow-up monitoring programs for health.

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Appendix B

Summary of European Union Environment and Health Principles (1989)

Environmental Health may be defined as “The creation of an environment conducive to the achievement to physical and social well-being”. Good health and well-being require a clean (safe) and harmonious environment in which the physical, psychological, social and aesthetic factors are all given their due importance.

New policies, technologies and development should be introduced with prudence and not before prior assessment of their potential environmental and health impacts. When doubt exists as to the likely impacts, the developer has the responsibility to show that the project is without negative health impact.

Considerations of economic efficiencing and trade, for example, should not be allowed to prejudice the health and safety of individuals and communities.

All development projects should be subject to a rapid and simple health impact appraisal. This action must aim at both preventing and reducing adverse effects caused by potentially hazardous agents and the degradation of urban and rural environments. The environment should be treated as a resource for improving living conditions and improving well-being.

Environmental standards need to be developed and kept under review to take account of new knowledge on environment and health, and of the effects of future economic development. This includes the application of the principle whereby every public and private body which causes environmental damage is made financially responsible (the polluter pays principle).

To achieve proper consideration of health impacts, the full collaboration of public health professionals is essential. Public health experts, therefore, need to be convinced that they should contribute to the appraisal of development projects which are susceptible to having an influence on the environment and human health.

To assist this approach, criteria and procedures to quantify, monitor and evaluate health damage in relation to environmental conditions should be developed and implemented within the framework of environmental impact assessment (EIS).

Public health services involvement in EIA which is an inter-sectoral activity, is strongly recommended by the World Health Organization. To make a positive contribution, public health professionals must be trained in EIA concepts and methods.

NOTES