

# **Health Aspects of Environmental Impact Assessment: Proceedings of a National Workshop**

**May 26 - May 28, 1987  
Ottawa, Ontario**

**Canadian Public Health Association**

Sponsored by:

Federal Environmental Assessment Review Office  
Canadian Environmental Assessment Research Council  
Health and Welfare Canada  
Environment Canada  
Ontario Waste Management Corporation  
Atomic Energy Control Board  
Pan American Health Organization  
Canadian Public Health Association

**A Manuscript Report Prepared for the  
Canadian Environmental Assessment  
Research Council  
1987**

## FOREWORD

The Canadian Environmental Assessment Research Council (CEARC) was established in 1984 by the federal Minister of the Environment through the Federal Environmental Assessment Review Office (FEARO), to advance the theory and practice of environmental assessment (EA). As part of its commitment to improve EA in Canada, CEARC encouraged research in several areas related to environmental assessment. The research results are presented in three series of publications: Research Prospectus, Background Papers and Manuscript Reports.

This report is part of the Manuscript Report series which is composed primarily of individual research papers sponsored, completely or in part, by CEARC. The Manuscript Reports are provided in the language and format in which they were submitted. **They are not** subject to **peer review and do not necessarily reflect the views and policies of CEARC.**

Microfiche copies of CEARC publications can be ordered through:

Micromedia Limited  
165 Hotel de Ville  
Place du Portage, Phase II  
Hull, Quebec  
G8X 3X2

Tel :1-800-567-1 914 (Canada), (819) 770-9928  
Fax : (819) 770-9265

For more information on **CEARC's** work, please contact:

Federal Environmental Assessment Review Office  
Process Development Division  
14th Floor, Fontaine Building  
200 Sacré-Coeur Boulevard  
Hull, Quebec K1A OH3  
Tel : (819) 953-8591 or 953-0036  
Fax : (819) 994-1469

- \* Her Majesty in Right of Canada owns all intellectual and other property rights and title in the CEARC Reports.

## **WORKSHOP PLANNING COMMITTEE**

Dr. Franklin M. M. White  
Canadian Public Health Association

Dr. Stan Winthrop  
Health and Welfare Canada

Dr. Gordon Beanlands  
Federal Environmental  
Assessment Review Office

Mr. Bob Weir  
Environment Canada

Dr. Husain Sadar  
Federal Environmental Assessment  
Review Office

Mr. John **Beare**  
Atomic Energy Control Board

Ms. Audrey Armour  
Canadian Environmental Assessment  
Research Council

Mr. Michael Scott  
Ontario Waste Management  
Corporation

## **WORKSHOP CHAIRMAN**

Dr. Franklin M. M. White  
President  
Canadian Public Health Association  
and  
Professor and Head  
Department of Community Health and Epidemiology  
Dalhousie University

## **WORKSHOP RAPPORTEUR**

Professor Raymond P. Côté  
Associate Director  
School for Resource and Environmental Studies  
Dalhousie University

## TABLE OF CONTENTS

	<b>PAGE</b>
INTRODUCTION.....	1
KEYNOTE ADDRESS.....	2
COMMENTARY.....	7
CASE STUDIES .	
EIA in Europe .....	9
Point Lepreau Nuclear Generating Station .....	16
Water Supply Project for Guadalajara, Mexico.....	20
WORKING GROUP REPORTS	
1. Scientific/technical.....	28
2. Procedural .....	33
3. institutional/jurisdictional.....	37
4. Socio-political .....	39
RAPPORTEUR'S SUMMARY.....	43
APPENDIX I	
ABBREVIATIONS .....	46
APPENDIX II	
GLOSSARY OF TERMS.....	47
APPENDIX III	
LIST OF PARTICIPANTS.....	50
APPENDIX IV	
WORKING GROUPS.....	53

## **ACKNOWLEDGEMENT**

The Planning Committee wishes to thank Corinne Burke and Karen Hall for their invaluable assistance and support in the planning and implementation of the Workshop. The Planning Committee and the Canadian Public Health Association also wish to express their gratitude to the School for Resource and Environmental Studies, Dalhousie University, for producing the proceedings. In particular, we want to thank Professor Raymond Côté for editing the proceedings and Mrs. Gina MacPhail for typing them.

## INTRODUCTION

The National Workshop on the Health Aspects of Environmental Impact Assessment was convened to respond to a need identified by the several sponsors to review the role that health professionals have played in environmental impact assessments (EIA) in Canada, and to discuss approaches and mechanisms for achieving greater involvement in the future. The co-sponsoring agencies reflect the breadth of interest in bringing public health considerations into Canada's environmental impact assessment processes. They were:

Federal Environmental Assessment Review Office  
 Canadian Environmental Assessment Research Council  
 Health and Welfare Canada  
 Environment Canada  
 Ontario Waste Management Corporation  
 Atomic Energy Control Board  
 Pan American Health Organization  
 Canadian Public Health Association

These agencies along with the Canadian Public Health Association which organized the workshop, have **recognized** the lack of involvement of health professionals and the limited consideration of public health issues in formal EIAs in this country. This workshop is an attempt to identify the constraints and find ways of overcoming them and, thereby, to facilitate participation and cooperation between the EIA and health communities.

The objectives laid down through an iterative process among the co-sponsors were:

1. to incorporate public health consideration into environmental impact assessment in Canada;
2. to determine roles and responsibilities for achieving greater involvement of health professions in EIA activities; and
3. to identify mechanisms for developing stronger operational and research links between the EIA community and relevant health professionals.

The **workshop** began with a provocative paper by Professor David Bates of the University of British Columbia. Three respondents were preselected to comment on his paper and identify other issues of relevance to the objectives. The respondents were Dr. Don Johnston, Occupational Health Consultant for Dome Petroleum; Dr. Jack Siemiatycki, Epidemiologist at Institut Armand Frappier; and Dr. Kate Davies, Department of Public Health of the City of Toronto. Workshop participants were also encouraged to debate and discuss the issues raised by Dr. Bates and his respondents.

During the first afternoon, three case studies were presented to describe the type of health issues raised in project development and EIAs in various parts of the world. Presentors were also asked to describe the role of health professionals and the degree of health impact assessment that was undertaken. Mr. Ian Waddington discussed the historical development of EIA in Europe with special emphasis on studies in the Netherlands and Poland. Dr. Mary Measures discussed the environmental impact assessment for the Lepreau 2 Nuclear Power Generating Station proposed for New Brunswick focussing on the health issues raised during the process. Finally, Dr. Mauricio Athie described the status of EIA in Mexico's development projects emphasizing a water distribution project for the city of Guadalajara.

During the second day, the participants were divided into four working groups to come to grips with the **scientific/technical**, procedural, institutional/jurisdictional, and socio-political constraints with a view to making recommendations on the means by which these might be overcome in the future. Finally, each group reported to a plenary session and the **rapporteur**, Professor Raymond Côté brought the key issues together into a final presentation.

KEYNOTE ADDRESS  
to the  
WORKSHOP ON HEALTH ASPECTS OF ENVIRONMENTAL  
IMPACT ASSESSMENT  
by  
**Professor David V. Bates, MD, FRCP, FRCPC, FACP, FRCS,  
University of British Columbia**

When I received the outline for this workshop, it became clear that we were going to cover a great deal of ground. Also, the intention of the planners was that I should, in this introductory talk, look over this landscape, and provide not only a background but also some provocative comments so that you will be individually stimulated to protest, or amend, or to add to what I have to say. I should immediately point out to you that one of the difficulties of all environmental discussions and debates is that no one person combines knowledge in depth of all the relevant disciplines. It is a truism to point out that environmental problems are by their nature interdisciplinary; this is both a problem and a challenge. I can claim some knowledge of respiratory diseases (and the lungs are in the front line of major organs first affected by environmental influences); some experience and interest in epidemiology; experience of an interest in, the enquiry process; and a lifetime spent in research. From this brief list, you can judge the deficiencies for yourselves.

#### HISTORICAL BACKGROUND

It is always well to begin with a review of what we have learned and how we came by that knowledge. I will use three examples. The gross coal-burning pollution in Pittsburgh in the years before World War II was well known. A small group of individuals, including one physician, decided to try to get legislative action against it. They had no health data, and never obtained any. There was no official participation by an organized health group. They decided that existing elected civic officials would never take the problem seriously, and they eventually campaigned to replace them, and won. The first anti-pollution legislation was then enacted.

London's air pollution was famous; and in the late nineteenth century it was forecast that one day it would 'suffocate'. There was no research on adverse health effects however. The smog in December 1952, which reduced visibility to a few yards for several days, was the worst in a series which had occurred for fifty years. Three weeks after it occurred, a tally by the Registrar showed that about 4,000 excess deaths had occurred. Lord Ashby has carefully reviewed the history of British reaction to air pollution; he concluded that nothing was accomplished by virtue of government initiative--indeed the main role of government had been to prevaricate and delay. No major campaigns had been launched by health groups either to determine whether adverse effects were occurring, or to get action taken to reduce the pollution level. After the disaster, individuals and health groups became involved, and as a result of their pressure and some subsequent less severe episodes, and the clear demonstration of mortality related to such episodes and to the smoke level in general, the Clean Air Act was passed.

When uranium mining was first proposed at Elliott Lake, there was no active involvement as far as I can discover, by medical or public health or occupational associations, on the question of what radiation monitoring should be instituted; what health surveillance, or what prospective epidemiology should be in place before work began. This is remarkable, since all medical textbooks in the 1930's knew about the radiation risk of mining radioactive ores.

From these examples, it seems safe to conclude that historically, very little positive action has been due to the initiative of governments. At best, these have been sensitized and have become reactive. Professional associations have become reactive as a result of the environmental movement of the 1960's.

## PROSPECTIVE ISSUES

At this point, we should note that since the 1960's, there have been an increasing number of instances where prospective studies of environmental issues have become common. The public hearing on the New Brunswick Power Corporation's bid to build a nuclear generating plant at Point Lepreau (which this workshop is taking as a study case) was the first public test of the new Federal Environmental Assessment Review Process (EARP). It illustrated the problems connected with its implementation and the need for reform. A one day public meeting constituted the only formal "public" phase of the Lepreau project. At the hearing, there were 19 briefs from private citizens; 8 from ad hoc advocates; 3 from business organizations; 1 from a University; and 1 from government. Where was the formal representation of health professional groups?

A one-day public meeting called to discuss a proposed uranium mine near **Clearwater** in British Columbia got a local family practitioner involved--to his great credit. But no public health official spoke or asked a question as far as I can determine.

Some studies have been partly reactive, and partly prospective. The Ontario Royal Commission on Asbestos had to advise on what to do about asbestos already installed in public buildings; there was **very** active participation by health professionals, and the coverage of health and epidemiological data was very thorough. The Uranium Mining Inquiry in British Columbia, which I had the honour to chair, had to advise on the hazards associated with uranium mining, and the **health** and environmental precautions that would be necessary. Participation by health professionals of all types was reasonably satisfactory, and the evidence heard by the Commission covered the knowledge then available of the hazard of exposure to radon daughters (we know now that these are more dangerous than we **realized** in 1979). The BC Medical Association participated actively in cross-examination and in presenting data. The CPHA Report on arsenic in Yellowknife was, I think, mostly reactive; it answered the question of whether there was any present evidence of immediate hazard to the community. It was not required to lay out a detailed strategy for the future. The recent Report on lead in the environment prepared by a committee chaired by Dr. Ken Hare of the University of Toronto, under the aegis of the Royal Society of Canada, was prepared for the guidance of Environment Canada. I have not yet studied the participation and involvement of health professional organizations or individuals in its preparation. This should have been a large part of the work of the committee, since, as I understand it, the most difficult but also the most important issue in relation to lead is its possible effect on brain development and behaviour of children to low levels of it.

## THE FORMAL INQUIRY PROCESS

All of these examples, and others, illustrate the fact that the enquiry process, in one form or another, is an essential component of all these issues. When I was on the Science Council of Canada, we commissioned a major study of such public enquiries in Canada (Background study 47 by Liora Salter and Debra **Slaco**, September 1981). I cannot deal with all aspects of this report in this introductory talk--but I would like to make two points; first that such enquiries provide the only opportunity for any 'open' discussion and examination of these issues in a parliamentary democracy, other than a standing Royal Commission on the Environment which Lord Ashby chaired in England. And secondly, that strong and well prepared participation by public health organizations is an essential feature. Such participation takes money--where should it come from? Other important points are why such enquiries are established; who selects the Commissioners? Should these include scientists, or are these just technical witnesses? Who represents the "Public Interest"; How is conflicting scientific (and particularly epidemiological) data discussed and by whom?

The public identifies formal enquiries as essentially judicial, with subpoena powers, court reporters, and evidence on oath. More important aspects of studies under the Public Enquiry Act are the fact that governments cannot interfere with them once they are launched; that funds can be made available to representational groups; that cross-examination is structured--that is, it occurs on the basis of documents which participants have had a chance to read in advance; and that they operate in the public domain.



## THE INFORMAL ENQUIRY PROCESS

Organized but non-governmental associations have often launched an informal enquiry of their own, issuing a report or statement of concern. By their nature, these are rarely comprehensive and always underfunded, since the associations lack the resources to pay special witnesses to attend or to provide the staff backup essential to a proper enquiry.

## THE ROLE OF THE MEDIA

I am not competent to review the role of the media in the environmental movement of the 1960's and in relation to environmental issues since then. The Canadian Senate report on the media stressed that the printed press was mainly influenced in what it published and how it described certain episodes or events, by what it judged would increase the sales of the press; once we accept that as a natural instinct for survival and do not expect that newspapers will act like scientific journals, we may regard all the media as simple amplifiers of both signals and noise. But essential in a democratic process. All public health organizations should have press officers accustomed to operate in such a complex world. No scientist interested in public health matters can ignore the media; none with experience expect to be completely or fairly portrayed nor that the balance of evidence will be presented in any kind of balanced format. At most, attention will be directed to "reasons for concern"; issues will be raised but rarely resolved. The difficulties faced by the conscientious journalist investigating an environmental issue in Canada were excellently presented by Warner Troyer in relation to the mercury problem in northern rivers (entitled "No Safe Place"). The immediacy of television which brings disaster, brutality and famine into our living rooms on a daily basis, is less easy to use in relation to such issues as asbestos, cotton dust, radon gas, or air pollution: epidemiological data is difficult to present, and rarely spectacular enough for the television producer, who will focus on interviews with breathless people instead.

## ANTICIPATORY DEMOCRACY

There is no doubt that raising expectations without fulfilling them is dangerous education. I often wonder how much crime and violence could be laid at the door of contemporary advertising. But the educated public has come to expect that our society will not proceed with large technical projects with a potentially major environmental impact, without careful anticipatory discussion. What we have not done is to provide any resources for that process to be satisfactory--except in isolated and relatively infrequent instances. One could claim that asbestos, lead, aluminum wiring, and uranium mining have had their day in court. What should be the role of professional groups in anticipatory enquiries and who should finance such endeavours? Where should the public debate on maximal exposure standards in Canada to radon daughters, to ozone, to pesticides of various kinds, take place? Is an "anticipatory democracy" in that sense, achievable?

If I had to pick an example of excellent anticipatory action in a democracy, I would point to the environmental assessment carried out prior to uranium mining in Northern Australia, noting the appointment of an independent Supervising Scientist with adequate laboratory and staff resources; able to report directly to government without a government department being able to change or modify his reports; and not able to be dismissed by arbitrary action of a minister. He acts in a way parallel to that of an Auditor-General, whose powers have to be statutorily defined.

## THE CANADIAN RECORD

At this point you might well remark that Canada has generally avoided any large scale disaster; that it has many positive achievements to its credit; and that we are well served by the Departments of the Environment and by Health and Welfare Canada. There is some credit to be distributed; there are some civil servants more concerned with these issues than the (often transient) ministers who move through the portfolios. In the USA, public reaction prevented the President from dismantling the effectiveness of the Environmental Protection Agency by appointing Secretaries who had little interest in the mandate of the Agency; in that country,

Congress passes laws and can act swiftly if it can prove that they are being disregarded by such agencies. We do not have an unblemished record, either in the occupational or the environmental sector; can we learn from our mistakes?

#### ESSENTIAL COMPONENTS OF ENVIRONMENTAL DECISION-MAKING

I would like to try to formulate the requirements for the future, as I have come to see them, in an unambiguous way so that you can challenge them and enlarge on them in your discussion over the next few days.

We require the following reorientations:

1. Freedom of Information is essential, and we still have difficulty getting essential information, particularly where this involves one government department (as Health and Welfare for instance) giving advice to another (Environment or AECB for example). Confidential Advisory Committees to ministers are inappropriate. As I have indicated, the public perceives that the main advantage of structured enquiries is that they are open.
2. Complex questions of safety standards for human exposure should be the main agenda of a new Council established to consider (in public) all such questions. The Canadian Centre for Occupational Health and Safety has not so far got round to this question, maintaining that if it had done so, it would have been abolished. But we need discussion of a **wide variety of issues**; what is required is an ongoing, financed, body which can take under advisement a long list of materials; can hear evidence; can subsidise studies by groups such as CPHA on specific questions; and, over the course of time, can establish an independent and scientific reputation which will ensure that no government can dismiss its recommendations.
3. We need to encourage, by every means possible, the scientific representation within the media, to offset the **politicization** of science which otherwise becomes taken for granted.
4. Associations of Health Professionals, once a need has been identified, must become aggressive in seeking government funding to permit a full study to be made. In many ways, it is better for public money to be used in that way than to build up an even larger central bureaucracy (which in any event can hardly become large enough to embody expertise in every given area). Areas of concern should be both prospective and reactive. In relation to other areas of government expenditure or misguided investment, it is not possible to make a case that expenditures on enquiries on environmental or occupational problems have been a **waste of money**. **The amount so expended has been minuscule** in relation to the magnitude of the problems which they have attempted to deal.
5. We need to clarify, particularly for the media, the role of 'science' on the one hand; and the inevitable differences of opinion that may justifiably exist in relation to policy even when all the scientific data is agreed upon--and the fact that trained scientists may differ in such judgements.

This kind of educational **proces** becomes essential when the political game is perceived in terms of discrediting individuals rather than in discussion of the validity of the data base on which a decision should be taken.

#### SUMMARY

The evolution of decision-making on environmental and occupational questions since 1960, from slow beginnings, has been a fascinating story; I suspect that historians will devote more attention to it than governments did at the time. The process is not static; is not frozen within one Constitutional framework or another: has been and will be steered by individuals as well as groups; and requires continuing and active participation by many different people if it is to make progress. This workshop is one of hundreds of processes that will be required to consider how we are to react to situations that, we are coming to see, are now beginning to threaten our survival.

You may feel that in Canada, where we have no famine, two thirds of the world's fresh water, and no air pollution problems of catastrophic proportions, we can afford to neglect all such issues. Not so. The western world, by its leadership in medical and public health matters, has played a major role in ameliorating diseases like tuberculosis, plague, and smallpox that decimated our forbears. Equally, such leadership is urgently required to address the increasingly important environmental issues of our time.

## COMMENTARY

Professor Bates provided a valuable historical perspective which underscored the weak link between environment and health though **recognizing** efforts to address environmental health issues were almost entirely reactive. Until quite recently, health professionals had very little influence. That situation is now changing. Health professionals, individually, and through associations such as CPHA are becoming more involved. He pointed to Ontario's Royal Commission on Asbestos, the Inquiry into Uranium Mining in British Columbia, the **CPHA's** studies of arsenic in Yellowknife and low-level flying in Labrador as examples which highlight the increasing involvement of health professionals. And he expects to see more prospective studies involving the medical profession and other health professionals.

During his presentation, Professor Bates stressed several issues that had to be **recognized** and addressed if effective debate of the potential impacts was to occur. The first was the recognition of uncertainty and risk due to our inadequate knowledge base and limited capability to predict and interpret. The second issue is openness and freedom of information including the need to provide funding to intervenors allowing them to participate in the assessment of impacts of a program or project. Education and the need to increase the scientific sophistication of the media was identified as a third issue. This was viewed as **very** important so that the public could separate the debate about facts of the problem from that of their significance.

Professor Bates noted a critical factor in such processes and that is the need for independent bodies to conduct assessments and to set standards. In his experience, formal inquiries are good models because they allow for cross-examination, funding for **intervenors**, access to all documentation, etc. Finally, he encouraged public health professionals individually and through their associations, to become more involved in the resolution of environmental issues because they have substantial expertise to contribute.

In his response, Dr. Johnson of Dome Petroleum explained why there has been inadequate consideration of the long-term environmental and public health implications of development. Business in Canada works on five year financial plans at best; "real time is the next stockholders meeting". Governments do not really look much farther than the next election and environmental problems have not been real political issues in the past. While the electorate does react to pollution problems, its attention is limited to today's disaster. Four, the medical community is forced by circumstance to emphasize pain, suffering and death of their patients on a day to day basis. Dr. Johnson did note that health professionals are routinely involved in discussions of occupational **health** and safety and medical contingency planning in industry. He concurred with Dr. Bates on the difficulties of accessing all the necessary information to participate in assessment of impacts. This will be especially contentious when it involves medical records of workers and may apply to in-plant monitoring data as well.

Dr. Siemiatycki commented from his perspective as an epidemiologist in the research community. He reinforced Dr. Bates' comments on the limitations of the data bases and our ability to interpret them by focussing on the relative usefulness and deficiencies of toxicological and epidemiological information to decision-makers. He pointed out that doctors and other health professionals are probably not very important in EIA if the strategy that the regulatory agencies would employ is that of limiting exposure. On the other hand, if the debate focusses on the significance of health impacts then health professionals and organizations are critical to the debate. There is a need to expand the epidemiological data base by doing follow-up health monitoring of projects, by supporting research into better health impact end-points and improving methodology allowing to interpret effects on human populations. However, Dr. Siemiatycki emphasized that a rough estimate is better than no estimate at all.

Dr. Kate Davies, speaking from a community health perspective reiterated that health and environment are inextricably linked and the public perceived this as the case with an expectation that problems should be addressed in an integrated fashion. Unfortunately, our institutions have so separated the disciplines, the agencies and jurisdictions that the public is generally distrustful

of the responses given partly because of the limited access to information and the fragmentation of the responses. She concurred that information, education and communication were central issues. This is particularly true in the debate on the risks and benefits of environmental and health impacts. Dr. Davies argued "for credible authoritative information on the environment" appearing to support Professor Bates' call for an independent agency.

She also agreed with the previous respondents regarding the development of more sensitive health indicators to assess human exposure and impacts of development. Cancer and mortality rates are clearly not adequate to permit responsive mitigation or remediation. Dr. Davies also stressed the importance of land use decisions such as siting, alternative uses, site reclamation as these have both biophysical and human health implications.

During the presentations and the ensuing discussion, one particular problem arose which is worthy of note. There is a definitional problem among disciplines and between the professional EIA community and others. There appeared to be confusion about the limits of EIA. Are EIAs only those conducted within the framework established by environmental impact assessment legislation or policies or do public inquiries, royal commissions and CPHA studies also constitute EIAs? Another problem of definitions focussed on the health professionals. As EIA is an interdisciplinary approach to problem-solving, it seems clear that involvement of health professionals should also reflect the many disciplines involved therein.

## CASE STUDIES

**Three cases were selected to** provide a range of perspectives on EIA and the manner in which health impacts have been addressed. The first presentation by I. Waddington of the World Health Organization discussed EIA and **EHIA** within the context of government planning and decision-making systems in Europe. The paper presented by M. Measures of the Atomic Energy Control Board described the impact assessment for a nuclear power generating station and its relationship to the nuclear regulatory process in Canada. The final case was described by M. Athie of the Pan American Health Organization in Mexico which dealt with the relationship of EIA and the Ministry of Health leading into a presentation on an impact assessment of a major infrastructure project to provide water for the city of Guadalajara.

### THE DEVELOPMENT OF **EHIA** IN EUROPE THE SEUSA CASE STUDY

I. Waddington  
**World Health Organization**

Primary reasons for applying environmental impact assessment methodology to the South eastern edge of the Upper Silesian Agglomeration (SEUSA) of mixed settlement and industrial development patterns are that it has been heavily degraded environmentally through a long industrial history, and that the experience could be used as an example for other regions. Another reason is that the government has prepared a five-year plan for development of this 650 square mile area. This plan includes hydroelectric power, new coal mines, a coal gasification plant, a smelter, a chemical plant and an expansion of existing industries.

Evaluation of the harmful effects on the human population has been carried out mainly by analyzing demographic and epidemiological statistics. In some rivers, water quality exceeds all standards for any use except firefighting. Air quality in the area is above all known standards. There is damage to the forests in the region due apparently to air pollution and in some parts of the region the soil is heavily contaminated by metals and hydrocarbons (see figure 1). Health statistics indicate that there are higher infant mortality rates in parts of the region than the average for the country; there are higher rates of some types of cancer when compared to reference groups; and the population is ingesting **significantly** larger amounts of lead and cadmium than considered acceptable by WHO.

Given the baseline conditions of the area, the government has posed the question: Is it possible in such an area of heavy **industrialization** to stimulate further economic development and give due consideration to all aspects of environmental protection? To ensure this question, an assessment of three **alternative** scenarios was conducted:

1. Stop further economic development and leave the status quo.
2. Encourage economic development of the pilot area in accordance with the plan.
3. Encourage economic development but with implementation of mitigating measures.

The environmental health impact assessment of the South eastern edge of the Upper **Silesian** Agglomeration (SEUSA) was conducted cooperatively by the WHO's European Office and Polish **authorities**. This pilot area is located in the eastern part of the Katowicz Voivodeship. The area covers **823,6** km\* and has a population of 264,800. The total work force (excluding agriculture) is 110,700. It includes six towns and seven communities. Physically, the region consists of two upland areas: The Silesian Upland and the Cracow-Czestochowa Upland, each with different topography and geological structure. The eastern portion of the pilot area is part of the Cracow-Czestochowa Upland and is made up of hard and compacted limestones. The western portion of the pilot area within the Silesian Upland is made up of carbon sandstone and

shale deposits with permian formation. The old and well-developed industry of the area is based on local mineral resources. The main activities include mining and smelting of zinc and lead ores, hard coal mining, coal-fires electrical production, chemicals, and building materials production.

The meteorological conditions depend on the movement of air masses mainly from the west and the east. The annual average air temperature is in the range of 7,1 to 8,0°C. Annual precipitation totals 700 to 820 mm. The growing season is 200-220 days long. The soils are generally poor. Most of the area is made up of fifth and sixth class soil. The agricultural area covers 32,800 ha which represents approximately 39.9% of the total pilot study area. The main crops grown are potatoes and rye. The area is extensively forested (over 42,5%) but a large part of that is of a poor grade.

Hydrogeologically, the area has great variations. In the western and northwestern portion of the area there are major flowing rivers such as the Biala Przemsza, the Przemsza and its tributaries. In the south are found the Chechlo, Ropa, Luszowka and the Gromiec Rivers. In the east is the Rudawa River. All these rivers are tributaries of the Vistula River.

The project began with a review of EIA methodologies (see figures 2, 3, 4) and the adaptation and the selection of a methodology for use in Poland. The process which was eventually used is as follows:

## EIA METHODOLOGY

### I. SCOPE OF ENVIRONMENTAL IMPACT ANALYSIS

#### ANALYSIS OF EXISTING ENVIRONMENTAL QUALITY

1. Description of the Natural Environment and the Socio-Economic Characteristics of the Region
2. Identification of Pollution Sources
3. Qualitative and Quantitative Inventory of Impacts
4. Spatial Distribution and Impacts of Pollutants
5. Preparation of Cause-Condition-Effect Network
6. Principal Regional Adverse Environmental Effects
7. Principal Environmental Components Potentially Adversely Affected
8. Assimilative Capacity of the Environment and the Region
9. Potential Human Health Hazard

### II. ANALYSIS OF FORECAST ENVIRONMENTAL QUALITY

1. Analysis of Siting Alternatives
2. Identification of Pollution Sources

PILOT AREA SOUTHEASTERN EDGE OF UPPER SILESIA AGGLOMERATION (SE USA)

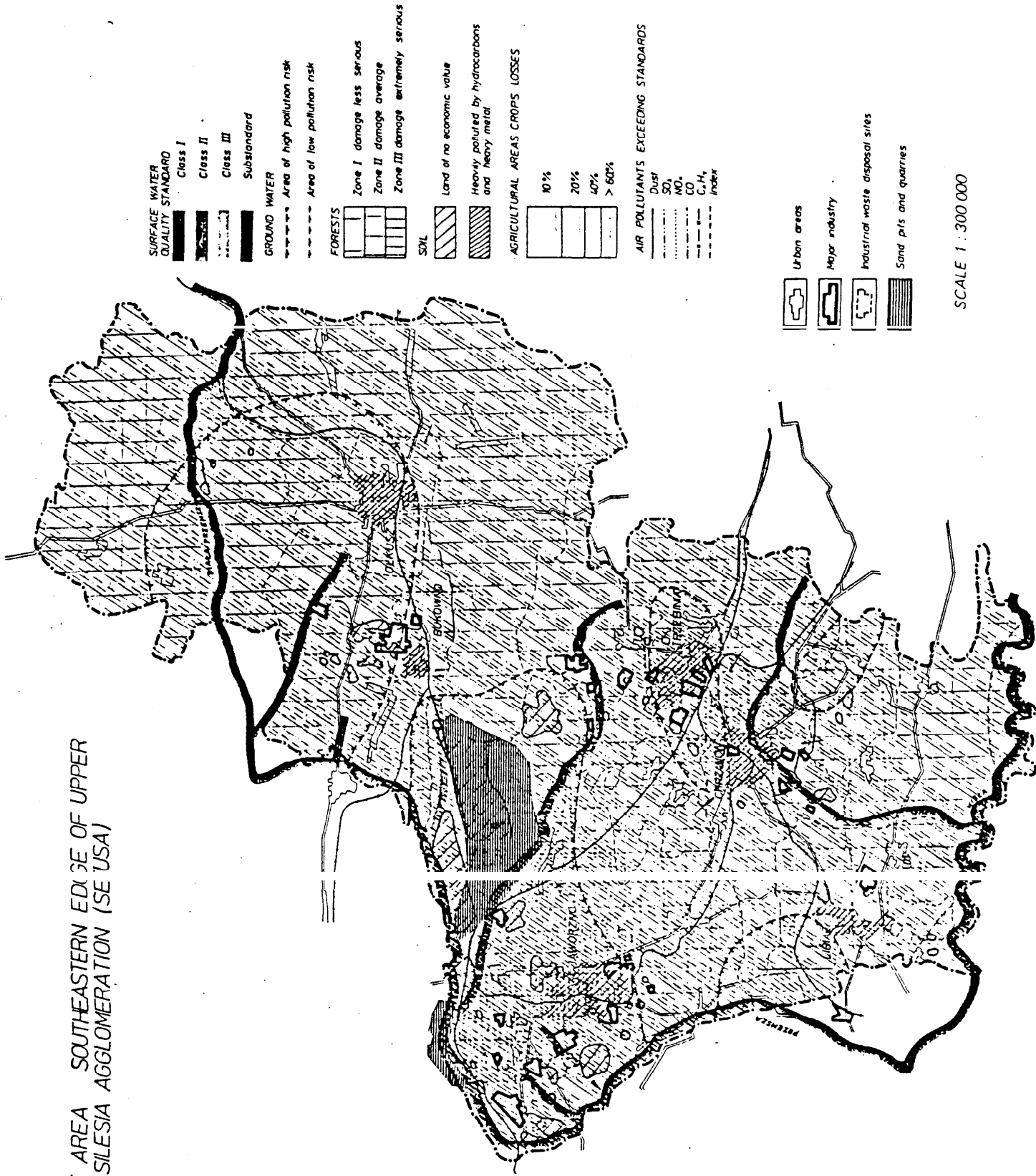


Figure 1. Spatial distribution of pollutants and degradation of the environment in the SEUSA.



---

Figure 2. STEPS IN PREDICTING HEALTH EFFECTS

---

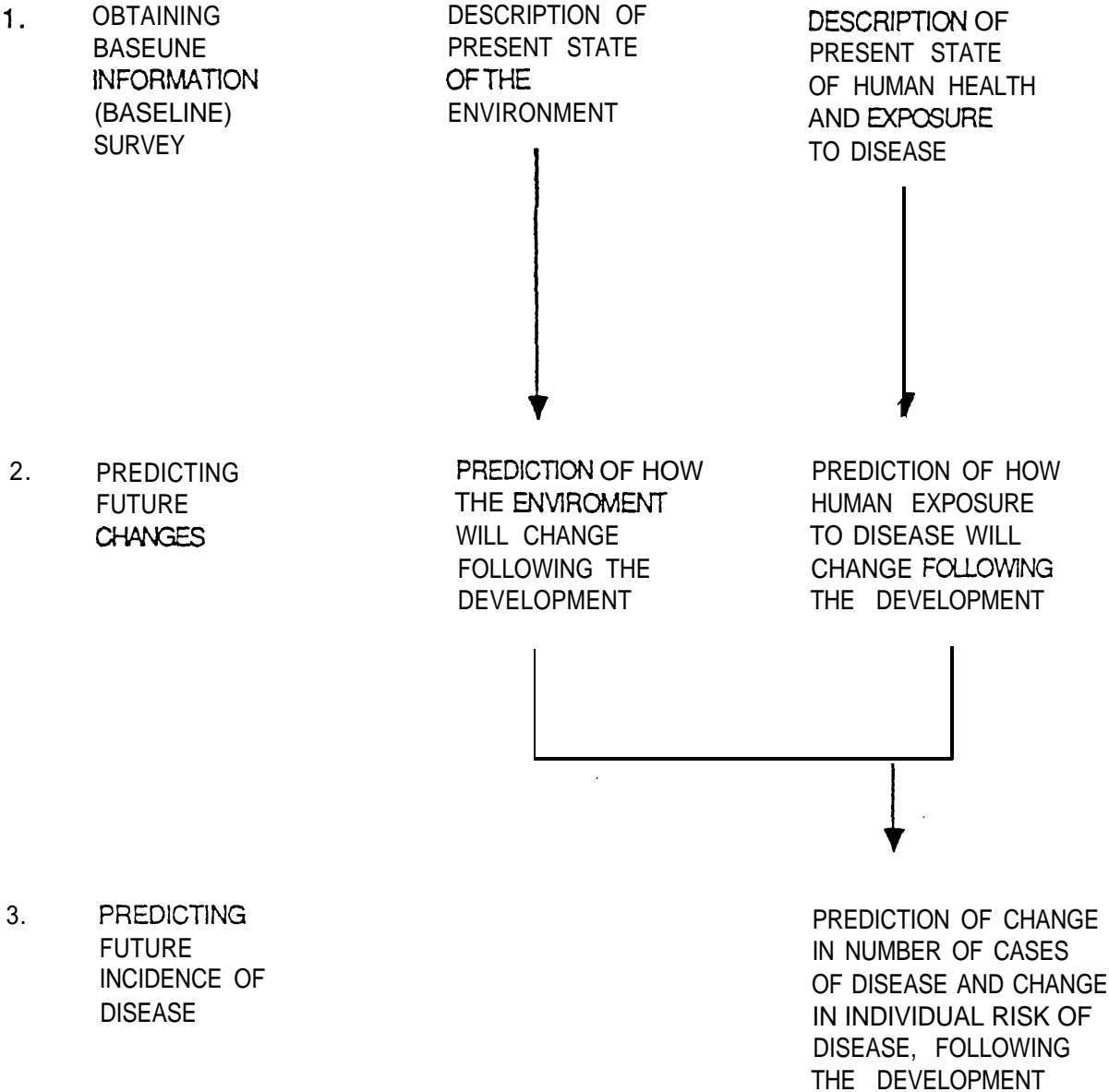


Figure 3. ENVIRONMENTAL HEALTH IMPACT ASSESSMENT PROCESS

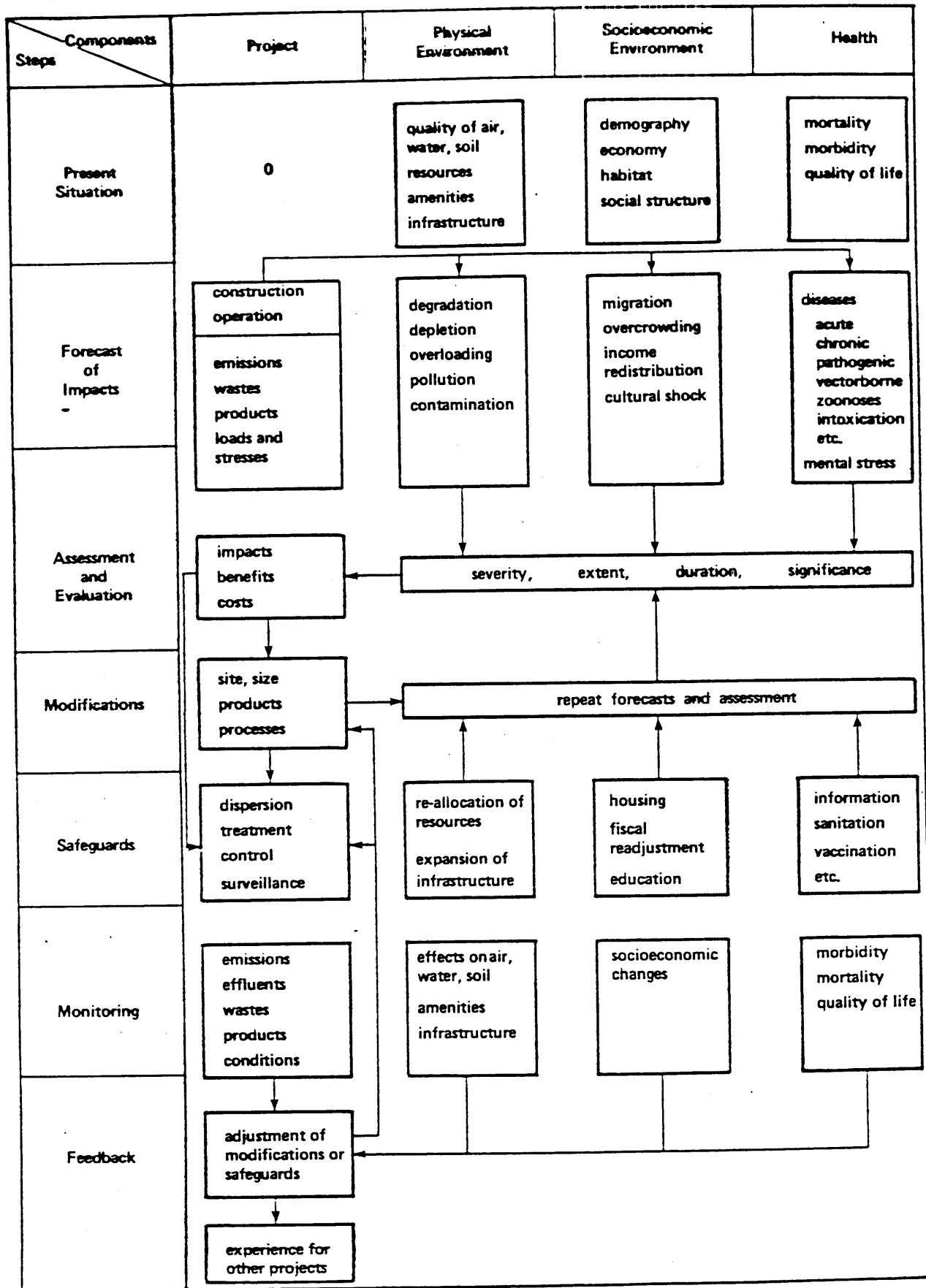
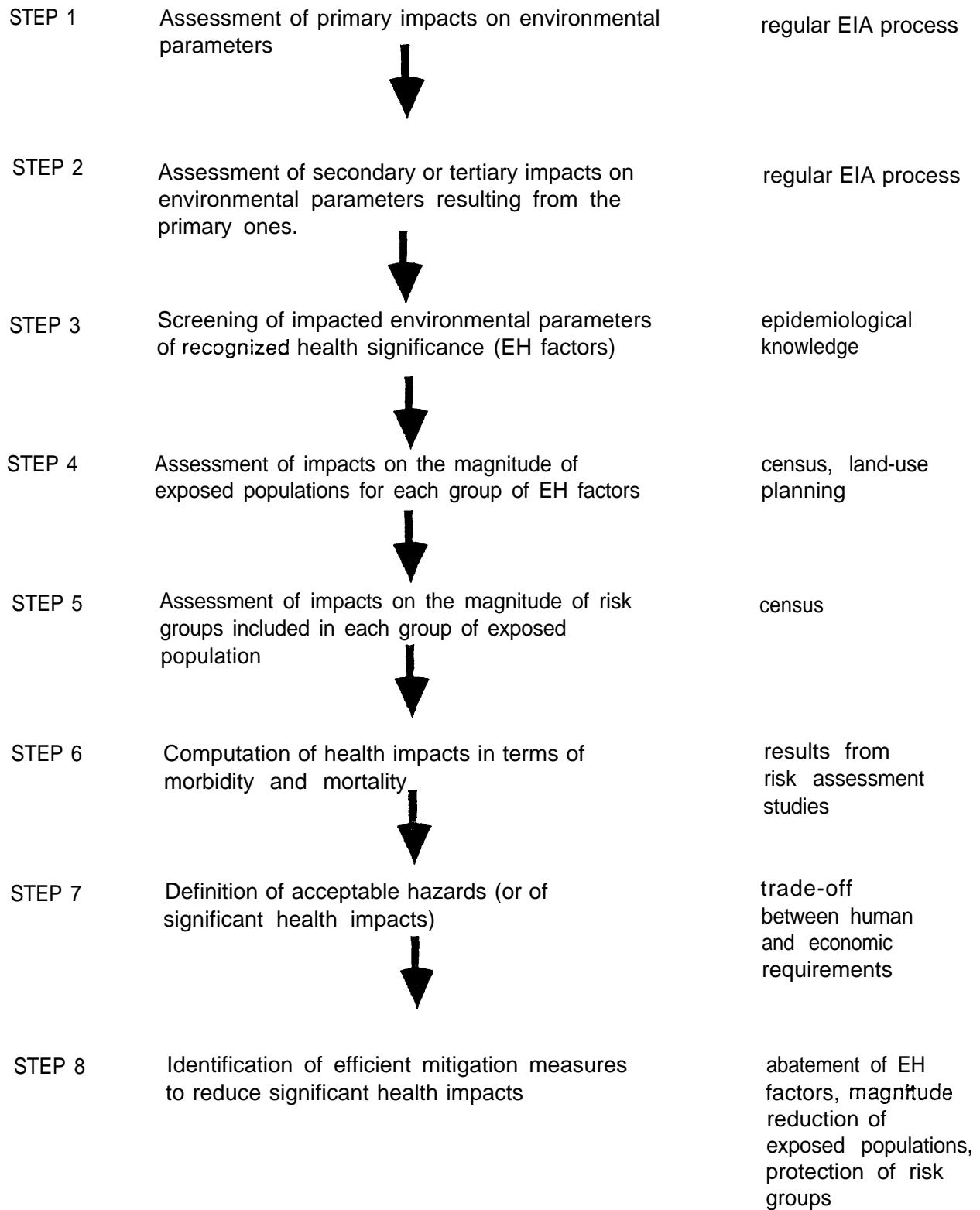


Figure 4. WORLD HEALTH ORGANIZATION SUGGESTED PROCEDURE FOR EHIA



3. Qualitative-Quantitative Inventory of Impacts
4. Spatial Distribution and Impacts of Pollutants
5. Re-evaluation of Cause-Condition Effect Network
6. Verification of Principal Adverse Regional Environmental Effects
7. Principal Environmental Components Expected to Receive no Impact
  - a. Effects of Spatial Alterations on Environmental Impacts.

### **III. METHODOLOGY FOR REGIONAL ENVIRONMENTAL ASSESSMENT**

1. Selection of Options for Detailed Evaluation
2. Detailed Evaluation and Weighting of Spatial Developments Elements
3. Ranking of Regional Potential Impacts
4. Evaluating Impacts on Different Land Use Components
5. Development of Matrix Comparing Environmental Impacts
6. Sensitivity Analysis of the Evaluation
7. Comparison of Impact Assessment for Different Options

### **IV. ANALYSIS OF MITIGATING AND PROTECTIVE MEASURES**

1. Selection of Mitigating and Protective Measures
2. Predicting Effect of Mitigating Measures
3. Determination of a Selective Monitoring Procedure

### **APPLICATION OF THE METHODOLOGY TO THE SEUSA REGION**

Several components were involved in assessing the present environment and forecasting the effects of proposed developments in order to find the most acceptable alternative.

1. Assessment of demography, industry, transport and means of communication, forestry, infrastructure and public health.
2. Quantitative assessment of present environmental quality in the region with particular emphasis on water quality in the upper reaches of the River Vistula.
3. Assessment of the environmental quality due to increased mining activity and coal use with particular emphasis on transformation of chemical air pollutants, including hydrocarbons, as well as on the effect of air pollution on solar radiation.
4. Selective monitoring of environmental quality including polycyclic aromatic hydrocarbons and radiation related to coal combustion.

5. Study of quantitative correlations between various elements of the environment as a basis for assessment of synergistic impacts of various pollutants on vegetation and public health.
6. Forecast of gaseous, liquid and solid wastes likely to be produced by the development program foreseen on the Vistula River and by the industrial projects foreseen in the South-eastern edge of Upper Silesian Industrial Region.
7. Assessment of the environmental capacity of the upper reaches of the Vistula River and lower run of the Przemsza River, due to planned construction of dams, locks and harbours as well as due to changes expected in water use and navigation.
8. Evaluation of the severity and extent of impacts associated with changes in the Vistula and Przemsza River.
9. Analysis of development works in the study area to identify those alternatives which would minimize the negative impact while fulfilling the essential functions.
10. Development of water management program for the SEUSA Region resulting in the rationalization of water use, deposit of industrial wastes and improvement of water quality.
11. Development of a system of safeguards to be incorporated into the construction and operation of projects to assure the best available means are used to minimize and control the environmental impact.
12. Activation of a permanent monitoring network in the Upper Vistula catchment as a basis for preventive and corrective actions.

## LEPREAU 2 NUCLEAR POWER GENERATING STATION ENVIRONMENTAL ASSESSMENT and REVIEW

M.P. Measures, Atomic Energy Control Board

Maritime Nuclear, an association of Atomic Energy of Canada Limited and the New Brunswick Electric Power Commission, was considering the construction of a second CANDU nuclear-powered generating station at the site of the existing Point Lepreau Generating Station, 42 km from Saint John, New Brunswick. As a result, a joint federal-provincial Review Panel was established in 1983 to assess the environmental and directly-related social impacts of the construction, operation, and decommissioning of a second reactor.

This paper describes the issues that were assessed and the process by which the review was undertaken. The role of the health professional in the assessment process is discussed.

### LEPREAU 2

The Point Lepreau Nuclear Generating Station is located on the southern coast of the province of New Brunswick. There are approximately 2000 people living in small communities within 8 km of the site. The closest major city is Saint John, 42 km away. Fishing, fish processing, and forestry-related industries are the main industries. In addition, a significant number of retired citizens live in this area.

The first unit of the Point Lepreau NGS has been operational since 1982. The reactor is a 630 MWe CANDU unit using salt water from the Bay of Fundy as the condenser cooling water. The second unit proposed for construction was to be identical to the first, although more recent discussions have considered the construction of a CANDU 300 unit, with an output of about 400 MWe. It is proposed to build the second unit adjacent to and south of Unit 1.

## FEDERAL-PROVINCIAL REVIEW PANEL

In 1983, the federal Department of Energy, Mines and Resources referred the Lepreau 2 project to the Minister of the Environment for formal review under the Environmental Assessment and Review Process. Environment New Brunswick was invited to participate in the assessment because of the provincial implications and because of provincial requirements for environmental assessment. As a result, a joint federal-provincial Review Panel was established. Its mandate was to undertake the review and to report and make recommendations to the federal and provincial Ministers of the Environment on the acceptability of the proposed project from the point of view of environmental and of directly related social impacts.

Both the scope of the review and the review process were clearly defined in the terms of reference for the Panel. Consideration was to be given to the effects of potential pollutants on the environment and the impact of construction, operation, and decommissioning of the facility on the environment and on local communities.

The review process included a public scoping exercise to identify major concerns prior to the development of guidelines for the preparation of the Environmental Impact Statement. Thirty persons, representing various interest groups, governmental agencies and individuals participated in the open houses and workshops conducted by the Panel. Topics raised were used by the Panel to identify the key issues outlined in the guidelines. In addition, an advisory group of experts was appointed by the Executive Chairman of the Federal Environmental Assessment Review Office and the New Brunswick Deputy Minister of the Environment to advise the proponent on the acceptability of study design and methodologies used to address issues considered important to the Panel and to report to the Panel on the adequacy of studies undertaken in support of the Environmental Impact Statement.

Following the preparation of the Environmental Impact Statement and its submission to the Panel, copies were distributed to the public and to governmental agencies for review and comment. Public meetings were then held during November and December, 1984, and a report containing the Panel's recommendations was submitted to the federal and provincial Ministers of Environment in May, 1985.

## ENVIRONMENTAL IMPACT STATEMENT

The guidelines set following the public scoping exercise identified six issue areas for comprehensive analysis. These were:

- impacts on the biological environment;
- impacts of radiation on humans;
- impacts on the socio-economic environment;
- monitoring;
- emergency planning; and
- decommissioning.

The guidelines specified the detail expected for each topic and the final Environmental Impact Statement included:

- i) general descriptions of the proposed unit and the biophysical and socio-economic environment;
- ii) impacts on the biophysical environment, including dissipation of heat from the outfall discharge, the effects of entrainment and impingement of fish larvae on the fish populations, and the handling of inactive waste;
- iii) discussion of the releases of radioactivity, including the significance of dose limits, derived emission limits and operating targets;
- iv) impacts on the social and economic environment, including labour requirements and supply, economic impacts and community impacts, e.g., land use, population and housing effects, transportation, commercial opportunities:

- v) planned programs for monitoring radioactive emissions and levels of radionuclides in the environment, occupational exposures, changes in the biophysical environment and socio-economic impact of the facility on the community;
- vi) emergency planning, including the roles and responsibilities of the licensee, and federal and provincial governmental agencies and the methods for informing and advising members of the public;
- vii) transportation and storage of used fuel; and
- viii) decommissioning, including a description of the options available for the safe removal of a facility from service at the end of its operating life and a summary of world-wide experience to date.

It should be noted that several of these topics, and clearly the most controversial ones, relate to public health and safety.

## PUBLIC MEETINGS

Following the receipt of comments about the Environmental Impact Statement by members of the public and from governmental agencies, additional information was requested from the proponent. Following its receipt, further public meetings were held.

Numerous presentations were made at eight sessions held in Saint John, Fredericton, and Pennfield, New Brunswick. Sixty-six persons attended the meetings. Of these, 27 individuals represented municipal, provincial, or federal governmental agencies, while only 12 were local residents or represented universities, colleges, or professional associations. The other 27 persons comprised the proponent and its consultants, and consultants to the Panel.

The Panel addressed the lack of public participation in its report, citing lack of concern, skepticism about the value of the review process, complexity of the issues, saturation due to the number of studies carried out, lack of resources of some groups, and a boycott by others dissatisfied with the scope of the review. Recommendations to help improve public participation were included in the 39 recommendations made to the federal and provincial ministers.

## ROLE OF THE HEALTH PROFESSIONALS

The Environmental Assessment and Review Process described above is only one component of the overall regulatory process applicable to nuclear facilities. The construction, operation, and decommissioning of a nuclear facility are regulated by licences issued by the Atomic Energy Control Board pursuant to the Atomic Energy Control Regulations. The AECB also licences prescribed substances from the time they are produced or separated from natural ores until safe disposal is completed. Part V of the Regulations limits the amount of radiation to which a worker or a member of the public may be exposed.

The Atomic Energy Control Board follows, to a large extent, the recommendations of the International Commission on Radiological Protection (ICRP). Dose limits are based on the results of world-wide epidemiological studies and on the premise that the risk to a worker from exposure to radiation, i.e., the probability of an adverse health effect, should be no higher than the risk from the occupational hazards in what are considered "safe industries". Also the risk to a member of the public, based on risks regularly accepted in everyday life, should be limited to one-tenth that of a person receiving the benefits of employment. Licensees are required to operate below the dose limit and further restrictions are applied to ensure that doses are kept as low as is reasonable for the circumstances in which the facility is operating.

The assessment of exposure to radiation and the control of dose are complex issues. This is where the health professional becomes involved.

Physicists in the late 1800s and early 1900s became aware of the biological effects of radiation. The physicists studying these effects promoted the obvious need to control hazards.

They became experts in radiation protection, and the term “health physics” was coined to describe the work done by this group of scientists.

Today, health physicists are no longer necessarily physicists, studying **health** effects, but are individuals trained in all aspects of radiation protection. These include the biological effects of radiation, the movement of radioactive materials through the environment, dosimetry, and all practical aspects of radiation protection. Health physicists are employed by the regulatory agencies, by other federal and provincial agencies, and by industry: these health professionals were involved in the environmental impacts of the Lepreau 2 study from its inception.

In Canada, there is a professional association for health physicists and other experts in radiation protection, the Canadian Radiation Protection Association (CRPA). Several CRPA members participated in the environmental assessment and review for Lepreau 2. However, their presentations were made as individual health physicists, representing the various governmental agencies and the proponent, not as members of the CRPA. This allowed for free discussion in a public forum and, in some cases, for the presentation of dissenting opinions among the health professionals. It is believed that this type of involvement contributed significantly to the comprehensive and exhaustive review that was undertaken.

## CONCLUSION

In the author's opinion, the Environmental Assessment and Review for Lepreau 2, within its limited scope, was carried out in a competent and effective manner. Members of the Panel and of the Advisory Group were selected because of their expertise in pertinent disciplines. Public participation was solicited prior to the preparation of the guidelines for the Environmental Impact Statement, to ensure that all relevant issues were identified and addressed. Poor participation by members of the public in the public meetings was unfortunate but was addressed in the recommendations of the panel. Health professionals, using the approach that people are the most important part of the ecosystem, were involved in the process from the beginning and contributed to a full discussion of health-related issues.

However, the purpose of this paper is not to pat ourselves on the back, but to promote discussion on possible improvements in all areas, especially non-nuclear areas. It should be **recognized** that one of the reasons health professionals were able to make a positive contribution during the Pt. Lepreau 2 study was because the health aspects of radiation have been well studied by a large number of people for many years. Epidemiological studies are ongoing on a national and international basis. These include studies on uranium miners, atomic bomb survivors, and medical patients. The results of such studies are **compiled**, analyzed and used as the basis for internationally accepted recommendations by international bodies such as the ICRP, IAEA, UNSCEAR and WHO.

This author's challenge to health professionals is to:

- look at the way in which the Lepreau 2 Environmental Assessment and Review was undertaken;
- see what aspects can be adopted to apply to other pollutants; and
- identify where the necessary data are not available and begin to set up research programs, including epidemiological studies, to obtain these data.

The approach used in the nuclear field is far from perfect, and there is a need for the continual refinement of procedures. However, the approach is a starting point from which strategies for non-nuclear industries can evolve.



WATER SUPPLY PROJECT FOR GUADALAJARA CITY, MEXICO  
HEALTH AND ENVIRONMENTAL IMPACT ASSESSMENT

**Mauricio Athié Lámbarri**

This paper describes the Environmental Impact Assessment of the Water Supply Project for Guadalajara City in Mexico. The work describes how the Mexican Government is organized regarding environmental protection, stressing the historic role of the Ministry of Health in the subject. It also describes procedures and methodologic guidelines for the preparation of EIA's in general and the way the EIA for the water supply project was prepared.

Guadalajara is situated in an extensive valley in the state of Jalisco in the west of the country. Due to its privileged geographical situation the Guadalajara Metropolitan Area is the most important cultural and economic center for development in the region and perhaps the second in the country. The conurbation, which includes the municipalities of Guadalajara, Tonalá and Zapopan, had a total population of 2.4 million in the 1980 census. Presently that figure has increased to around 3 million and if the present rate of demographic growth continues, by the year 2000 the area will probably have to cope with about 7 million inhabitants.

The Metropolitan area has traditionally suffered from deficiencies in the drinking water supply, which is worse in the months of March and April when the temperature goes up and precipitation decreases. The provision of water has been gradually increased as demand has risen, but has really never managed to completely satisfy the needs of the growing population. Almost 20% of the inhabitants live in shanty towns lacking in any kind of public service, which are growing up on the periphery of the city. There is growing industrial development with ever increasing demands on the water supply, while it is daily more difficult to find new sources which would provide an economic water supply.

Initially the city was supplied by the underground water table in the Valley of Tesisán, and later the water in Lake Chapala was tapped--this latter being the principal source today. The water is collected from the Santiago River as it leaves the lake, downriver from the urban-industrial complex of Ocotlán. At present this source provides 9000 l/s which consists of 7000 l/s from Chapala and 2000 l/s from the pumping system in the Tesisán Valley.

In order to cover the deficiencies in the water supply in the short term there are rivers in the vicinity which could be used fairly economically. However, so far there has been no viable solution found to provide a sufficient supply of water for the end of this decade, when the present available quantities will be totally in use. A project entailing a transference between catchment areas would take usually 7 or 8 years from study to construction phases.

Having studied various sources which could satisfy the estimated future demand for Guadalajara, the project based on using the Calderón and Verde rivers both tributaries of the Santiago, seem to offer the best prospects, the former in the short term and the latter in the longer term. It should be mentioned at this point that it has been considered traditionally that these rivers are a natural source of water supply for the Metropolitan area as the extreme fluctuations of Lake Chapala prohibit this water body from being considered a reliable source.

## CASE STUDY - ENVIRONMENTAL IMPACT STATEMENT OF THE USE OF THE RIO VERDE AND TRIBUTARIES FOR THE GUADALAJARA CITY WATER SUPPLY

At the beginning of 1982 the Ministry of Agriculture and Water Resources (SARH) contracted the preparation of an Environmental Impact Statement for the Rio Verde Project. The statement was prepared by a consulting firm under contract, with a group of professionals which included engineers, biologists, geographers, but not health professionals, following SARH's own guidelines for hydraulic infrastructure projects. The report was presented internally for evaluation and verdict without the intervention of the then competent authority, the Ministry of Health. It is important to stress at this point that SARH at this time insisted that statements were prepared for the Ministry's projects and for projects from other public sectors but systematically omitted intervention of the Ministry of Health.

The project is based on controlling the Rio Verde, a tributary of River Santiago, by means of La Zurda dam, which will be built in the lower reaches of the river, in order to use water for Guadalajara's water supply. In order to increase the availability of water the project also includes a second stage in which the Guadalupe and Tepatitlán Rivers would be tapped. The rivers join on the left bank of the Rio Verde, downstream from La Zurda dam by means of El Salto and Lagunilla dams, respectively. Furthermore, as a related project the use of the river Calderón, a direct tributary from the Santiago, was considered through the Tinajeros dam. In order to collect the water in the rivers and then take it to the storage tank which will be built in Los Vizcarra near the city, 28 alternatives were considered, using variables such as the use of the various sources available, the different points of collection available, the systems of conduction, whether it would be tunnels, pipelines, open canals or the river beds, and the most feasible routes, rates of flow and heights.

Using this study as a basis the two most likely alternatives were selected for feasibility studies. It was also decided to study the supply provided by river Calderon as an option to be carried out at short notice and with much less investment.

These alternatives are:

- a) Controlling Rio Verde by means of La Zurda dam, 110 km up river from the confluence with river Santiago. The reservoir would have a capacity of 790 million  $m^3$  including sediments, which would allow an annual extraction rate of  $13.5m^3/s$ . The extracted water would then be conducted along the same river bed until reaching El Purgatorio site where a dam of some 800,000  $m^3$  would be built. It is also foreseen that a 25 km access road to La Zurda would have to be built from the Guadalajara-Lagos de Moreno highway.

In the actual reservoir El Purgatorio a pumping station would be built capable of raising 14  $m^3/s$  to a level of 58 m by means of a steel pipeline, to the Las Mulatas hills where the potable water plant would be built. From the outflow of this point a conduction pipe with a capacity of 14  $m^3/s$  would take the water to the regulation tank in Los Vizcarra, then to cross river Santiago through a syphon to be built downstream from the Colmillas dam, and then on to the distribution tank in El Alamo.

Due to the great amount of seismic activity in the area all constructions will have to be built on adequate ground and all structures will have to be designed with this risk taken into consideration.

- b) The second alternative would take the waters extracted from La Zurda by means of a concrete tunnel 3 m wide and 85 km long, which would start at the extraction plant and end at the pumping station in Las Mulatas hill. The tunnel would be capable of handling up to 14  $m^3/s$ , while its construction would produce 850,000  $m^3$  or rubble. At the end of the tunnel situated in Las Mulatas hill a pumping station would be installed in order to rise the water 16 m to the treatment plant, where it dominates the Guadalajara Metropolitan Area. The rest of the system

is essentially the same as the first alternative, using the treatment plant and the conduction through pipe and syphon.

- c) Controlling the river Calderon by means of the Tinajero dam, 12 km up river from the confluence with river Santiago, with a design capacity of 1.5 m<sup>3</sup>/s. The conduction from this point would be by means of a steel pipeline 1.2 m in diameter and 27 km long in total. This is divided into three sections: first of all a 15 km stretch crossing river Santiago by a large bridge at 12.5 km going on to Tinajeros dam and the pumping station near Tonalá; the second stretch of 6 km goes from the pumping station to a 30,000 m<sup>3</sup> tank near Los Vizcarra and the third going on to El Alamo.

#### IDENTIFICATION OF ENVIRONMENTAL IMPACTS

The environmental impacts were identified by a screening method, carried out before the EIA was prepared, to determine whether or not it was necessary to carry out an exhaustive environmental impact evaluation and to define the environmental areas which should be carefully examined. This allowed the most severe impacts to be detected and whether or not some mitigating measures could be taken.

The evaluators in this case made a more detailed impact identification using the Leopold matrix and qualified the impacts according to importance and magnitude according to the methodology. This valuation is further discussed in later chapters.

#### THE ENVIRONMENT IN THE PROJECTS AREA OF INFLUENCE

The project's area of influence is situated in the northwestern part of the state of Jalisco, occupying the Los Altos and Guadalajara areas of the Volcanic Axis province. Both areas are in the lower reaches of Rivers Verde and Calderon which then extend to the upper basin of the Santiago. The area requiring changes in land use is of some 3687 hectares, including La Zurda and El Purgatorio dams catchment areas, the pumping station, the conduits and the reservoirs. The river Calderon project would occupy 1363 hectares.

The hydrological characteristics of the project's area of influence depend on the rivers Verde and Calderon. River Verde, before reaching River Santiago, drains an area of 20,502 km<sup>2</sup> whereas in La Zurda it dominates a basin of some 17,241 km<sup>2</sup>. The average annual runoff of River Verde is 635 million m<sup>3</sup>. River Calderon joins River Santiago some 30 km upriver from River Verde's confluence and drains an area of 1100 km<sup>2</sup> with an average annual runoff of 71 million m<sup>3</sup>.

The area involved takes water from Rio Verde, Valle de Guadalupe, Tepatitlán and Calderon rivers, which are all polluted by domestic, industrial and agricultural wastewater. River Santiago which supplies Guadalajara with water from Lake Chapala receives discharges from communities and industries which lower its quality even further. The bacteriological analysis of this body of water finds them to be "unsuitable for human consumption"; however, tests were carried out that proved that the water is suitable for distribution after treatment based on cogulation, filtering and disinfection.

Water quality, which is of paramount importance in the study, was based on samples taken in 1980, 1981 and 1982, in River Verde and its tributaries, River Calderon and River Santiago. The parameters studied include pH, temperature, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, grease and oil, settleable solids, detergents, turbidity and total coliform count.

The analysis of the River Santiago at Lake Chapala's outflow would give the best indication of the level of pollution in the lake. However, the data are quite old and do not include toxic substances such as heavy metals, pesticides, etc. Although River Santiago is more polluted than either River Verde or River Calderon, the report does not reflect the grave quality problems

that the water treatment plant faces, and will face in the future, one the water supply from Lake **Chapala** starts being used.

Geologically speaking the area is largely volcanic in origin, but due to unstable clay and topsoil the wet season can produce landslides which increase the turbidity of the waters and should be considered in the planning of the project.

The atmosphere in the zone suffers from pollution caused by local industries and the traffic on the 1342 km of roads in the area. There are also large areas of crops, which produce dust storms during the dry season, further deteriorating the air quality, specially in the Guadalajara Metropolitan Area.

A temperate **subhumid** climate prevails in the area of influence with some fluctuations between the higher and lower attitudes, with an average temperature in May, the hottest month, or some **23°C** and an annual precipitation of 1000 mm.

The soil in the area is suitable for agriculture if properly managed which unfortunately is not the case, leading to soil damage and low economic returns. The crops cultivated are mainly staples to satisfy the basic needs of the population-corn, beans, barley, wheat, chick peas, **chile** and maguey (**agave**), and some sorghum and alfalfa for forage.

The flora in the region was found to be already suffering from the effects of the introduction of foreign plants. The mezquite (**Prosopis juliflora**) has taken hold due to over pasturing. This bush uses up large quantities of water from the soil and subsoil, to the detriment of the rest of the plants. The water hyacinth (**Eichornia crasipes**) an aquatic weed from the Amazon basin once introduced as an ornamental plant, has proliferated and now covers extensive areas of water in the region. This weed increases the loss of water in the rivers through evapotranspiration, impedes the growth of aquatic fauna, affects the flow of water and is an obstacle of local navigation.

The area has a large population of fauna and the only hunting **practiced** is by the peasants who hunt for food. However, the lack of control over this activity has made it particularly destructive and several species have already disappeared, such as wolf, wild cat, white-tailed deer, pumas and wild bear. The mountain cat, the armadillo, grey fox, badger and rattlesnake among others are in danger of extinction. Some healthy communities of wild life include flocks of indigenous and migratory birds, small mammals such as rabbits, hares, raccoons and coyotes, as well as amphibians and lizards.

The comparison between the highlands, where the collection and conduction of the water will take place, and the Metropolitan area, where the resources will be distributed is very informative. In all services - housing, medical services, education, employment, roads, electricity, running water, etc. - the metropolitan area is considerably better off than the catchment area. This helps to explain the negative migration in the highland, while Guadalajara's population continues to grow at an average of 5% annually reaching 11% in the Zapopan municipality.

The conditions of health and the most common illnesses are also peculiar to the two different areas. The most common diseases in the highlands population are caused by the lack of drinking water and drainage, e.g. salmonellosis, shigellosis, infectious hepatitis, amoebiasis. These illnesses along with influenza and pneumonia are the principal causes of death in the area. These conditions also prevail in the miserable shanty towns around the metropolitan area of Guadalajara while in the city itself the principal causes of death are enteritis, influenza, pneumonia, heart disease, accidents and malignancies.

Finally, in the discussion of the human factor in the project's area of influence, once again we find that the population most affected and least benefited is also the least informed.

## ENVIRONMENTAL CONDITIONS IN THE AREA 10 YEARS AFTER THE STUDY

It is to be hoped that in the space of the next ten years the results of the many policies of the Federal Government in areas of family planning, population distribution, environmental conservation, and regional development will be felt and that the present tendencies to unbounded growth with all its attendant consequences in the Metropolitan Area will be modified.

However, given the fact that these changes are very gradual, it will probably not be until the end of the century that the substantial alterations that the area needs will begin to be felt. The Rio Verde Project will not be in operation within the next ten years and the demand for a sufficient water supply will continue to grow. This means that a short term solution will have to be found meanwhile. With this in mind, despite the drawbacks for the Lake Chapala supply, the construction of a conduit from the lake to a treatment plant has begun. This plant should go into operation sometime this year. This measure will provide some additional 7.5 m<sup>3</sup>/s to the metropolitan area while the Rio Verde and Calderón projects await a final date for commencement.

## IDENTIFICATION, MEASUREMENT, INTERPRETATION AND CLASSIFICATION OF ENVIRONMENTAL IMPACTS

The infrastructure of the Rio Verde projects will produce a series of impacts on the environmental factors in the area of influence. The significance of these impacts was identified using an adapted Leopold Matrix. The relative importance of each of those environmental impacts was calculated using the comparison method, assigning values from 1 to 10 for magnitude (environmental effect scale) and importance (estimated by evaluator). The positive or beneficial effects were given a plus (+) sign, while the negative or detrimental effects were given a minus (-) sign. Every interaction in the matrix was thus quantified by a variable between -10 and +10.

Although this methodology presents problems and the estimations are somewhat subjective, it allows us to identify the significant impacts. It should be noted here that an adapted Leopold matrix was used for identification instead of that usually recommended in the Environmental Impact Procedure. SARH considered the technique used in this case adequate for identification purposes, it was approved for measurement also, although with some reservations.

The analysis discovered that the preparation of the site would not produce any environmental impacts, while the construction stage would produce the most significant effects. The most important effects that can be pointed out are those beneficial to employment and the change in quality of life experienced by the population in the area of influence. With reference to the dams and reservoirs, they were given high values due to the detrimental effects on the displaced population, the irreversible changes in the uses of soil which this action produces and also the change from an entirely terrestrial ecosystem to an aquatic ecosystem, and the river from a "lotic" state to a "lentic" one.

In the operational phase of the project the highest value, both in importance and magnitude, was given to the actual water supply which would reach Guadalajara, with all the repercussions in health and well being for the population. It was also noted that the river Santiago would receive more waste water as a result of this increase in water supply, and this was noted as a significant impact.

For the environmental evaluation a comparison was made between the effects produced and the quality standards in force in the Mexican legislation. Legislation in environmental protection in Mexico is rather disperse and historically refers to problems of environmental pollution, principally air and water. The environmental evaluation therefore had to concentrate mainly on treatment required to render the water supply suitable for human consumption. For other environmental factors subjectivity was used freely.

It is particularly noticeable that the health aspects had been described so briefly. The repercussions of the project on the health of the population affected were not discussed or

**analyzed** as deeply as they should have been, nor was the possibility of importing illnesses from other areas by the movement of workers. A further problem that was almost totally ignored was the effects the reservoirs and pools could have on endemic diseases. Another grave concern for public health is the level of pollution of Lake Chapala, which is supplied by River Lerma, one of the **most** polluted of the country. This situation is critical due to the fact that at present and in the short term Guadalajara's water supply will come almost entirely from this water body.

#### MITIGATING MEASURES

It is assumed that if the environmental impact assessment is to be used as a planning tool the results should be taken into account in the decision making process.

Given that the selection of alternatives had already largely been made, the introduction of the environmental factor in this project was limited to determining mitigation measures for the negative impacts.

The only mention of selection of project alternatives was the preoccupation of the population and Government of the City for possible disproportionate rises in the cost of water. Since the cost of water depends mainly on operational costs, was the reasoning, these costs should be kept low by selecting the tunnel alternative, whose construction costs are high but little financial resources are needed for its operation since pumping is minimum.

The proposed mitigating measures were as follows:

1. The impacts produced by the access roads and construction sites should be mitigated by minimizing cuts and fillings, but keeping at the same time the necessary safety standards.
2. The camps should be set up at some distance from existing population **centers** in order to avoid social problems. However, the camps must be situated near enough to allow the services of water, electricity and drainage to be installed. Finally, at the end of the useful life of the camps, the area should be rehabilitated to its previous state.
3. The areas to be submerged by the reservoirs should be totally cleared of vegetation in order to avoid later problems with eutrofication. The wood can be sold to offset the cost of clearing. It was recommended that suitable aquatic fauna should be introduced to the reservoirs and that recreational uses of the water bodies be encouraged (fishing, sailing, etc.). In order to control the area only installations which would not pollute the water should be permitted. The people who will have to be displaced due to the flooding should be adequately reimbursed and given help in resettling. A management program for the hydrological basin should be implemented in order to extend the life of the reservoir.
4. With regard to the construction to be undertaken it is necessary to make use of the material taken from the excavations. In the case of further material being needed, it should be taken from sites outside the immediate area, and should be done rationally, avoiding all unnecessary removal of vegetation and, once again, all areas should be rehabilitated at the end of the excavation. Excavation material from the tunnel should be dumped in natural depressions which are free from vegetation and in areas where the natural waterflow is not interrupted. The zone should then be reforested with indigenous species. The effects produced by the control of the rivers and alterations in the rate of flow are seen as inevitable and irreversible.
5. There will be an increase in pollution of the River Santiago due to the increase in discharges and reduction in the water normally supplied by Rio Verde. This problem could be somewhat ameliorated by treatment and reuse of Guadalajara's wastewater.
6. Clearing of vegetation and leveling works which will be carried out in order to allow the construction of the conduits, pumping stations and treatment plants should be carried out as

carefully as possible, preserving as far as possible the trees and bushes whose removal is not strictly necessary.

There is also a series of impacts which are considered inevitable, however, their effect is principally local or temporary, in which case they can be considered minor. However, the control of the rivers and the reduction in run-off will produce inevitable impacts of great importance. The quality and style of life of the local population along the course of the river will be drastically affected due to their intimate relationship with these rivers.

## CONCLUSIONS

From the analysis of the procedures and guidelines on environmental impact in Mexico and the case study of the Guadalajara Water Supply, the following conclusions may be drawn:

Procedure. The Environmental Impact Procedure in Mexico now has a solid legal foundation and an adequate structure to allow a systematic evaluation of development projects. However, as can be seen in this case study the evaluation is still carried out on a case by case basis and the results are not necessarily taken into consideration in the final decision taken. This becomes quite evident when we take note of the fact that a water supply taken directly from Lake Chapala was considered unsuitable due to the bad quality and fluctuating quantity of the water in the lake, and nevertheless this was the alternative chosen for immediate action,

Methodology and analysis techniques. The guidelines issued for the Environmental Impact Statements are sufficient to obtain an objective evaluation; however, they do not emphasize the role of this kind of evaluation in the taking of decisions, and concentrate on the study of single environmental impacts and their reduction or elimination. It is important that the guidelines also include criteria for an environmentally compatible formulation as well as evaluation of projects.

Additionally the exhaustive description of the conditions of the project contrasts markedly with the description of the environmental impacts and the mitigating measures. It is evident that the recommendations which gave rise to the study should be discussed with the propounder of the project in order to effectively take part in the executive design of the project.

The analysis technique chosen, the Leopold Matrix, turns out to be rather complicated for identification of effects, which indicates that environmental screening is still a better option for this purpose. The Leopold matrix encourages subjectivity when used for measuring the impacts, is difficult to apply and of little use in making the final recommendation.

Health. The public health problem caused by the use of polluted water and the health impacts which the dams could cause are important points which should have merited closer attention. There is no evidence so far that the project itself would cause any increase in endemic illnesses or that, taken the necessary precautions, workers would import and spread any ailment. However, problems in the application of the EIA procedure makes it difficult to systematically assess projects, and therefore allows works with potential impacts to health to be approved and implemented without being subject to an EIA. Such is the case of the project to take water directly from Lake Chapala to Guadalajara.

The main concern about Lake Chapala project is the high amount of toxic and cumulative substances that River Lerma carries to the lake from industrial, agricultural and urban areas. These substances cannot be properly treated by using orthodox methods like coagulation, filtering and disinfection. A study is being carried out at present to upgrade the outflow from the treatment plant, which will deal with the water from Lake Chapala, for human consumption. If an EIA had been made at the right time, more adequate alternatives, such as those studied here, could have been implemented instead, along with water conservation policies in the City, allowing for the long construction times.

## WORKING GROUP REPORTS

The **Organizing** Committee for the Workshop assumed, when designing the program, that most, if not all, issues limiting greater participation of health professionals in EIA could be **categorized** as scientific/technical, procedural, institutional/jurisdictional and socio-political. All participants agreed this was a reasonable division acknowledging that overlap would undoubtedly occur.

Each group was then given some general guidance in terms of a few topics that should be considered by them.

### Scientific/Technical

- (1) baseline data - what is needed and how to get them
- (2) effective monitoring - the right indicators at the right place
- (3) predictive capacity - what can we predict with useful accuracy
- (4) study boundaries - on what basis should they be defined
- (5) methods/techniques - more applied research.

### Procedural

- (1) earlier planning - how to get involved at the start
- (2) target population - how to identify and contact
- (3) responsibilities - who has responsibility for what
- (4) decision-makers - how to get the message to them
- (5) audit/evaluation - how to learn from our experience

### Institutional/Jurisdictional

- (1) boundaries - mismatch between management and problem boundaries
- (2) time scale - short management horizons vs. long-term problems
- (3) agreement - cooperation between agencies and institutions
- (4) objectives - need for clarification and acceptance
- (5) corporate learning - how to **capitalize** on past mistakes

### Socio-Political

- (1) political agenda - how to get the attention of politicians
- (2) prevention vs. cure - the need for forward planning
- (3) public perspective of comparative risk - the need for public awareness and acceptance
- (4) government role - what are reasonable to government responsibilities
- (5) cost-effectiveness - demonstrate a sound investment

## 1. WORKING GROUP ON SCIENTIFIC/TECHNICAL ASPECTS

FACILITATOR R. MARCHAND

### 1.0 INTRODUCTION

The scientific/technical group used the WHO definition of health, discussed the EIA as a site specific process. In defining the scope of the working groups deliberations, the following questions were identified:

- i) What agents enter and leave the environment, and at what levels (quantity)?
- ii) Which agents should be assessed?
- iii) Is the database adequate to assess the agent?



- iv) If the data base is inadequate, what procedures should be followed to determine possible health effects?
- v) What are the known health effects of the agent?
  - qualitative
  - quantitative
- vi) Are there needs for ongoing, or prospective health monitoring?
- vii) What kind of monitoring should be undertaken? The discussion of monitoring covered its needs, effectiveness, and focus. Monitoring of agents can also provide data to test models used in EIA (e.g. dispersion models).

#### 1.1 FLOWCHART OF METHODOLOGY FOR THE INCORPORATION OF HEALTH EFFECTS DATA INTO THE EIA PROCESS

A flowchart (see figure 5.) was prepared to demonstrate the incorporation of public health considerations into an EIA. A second flowchart (figure 6.) prepared by J. Seimiatycki emphasizes the scientific contributions of toxicology and epidemiology. In this process research needs are identified for referral to appropriate granting agencies.

The flowchart can be used as a mechanism for the assessment of effects on humans, to their physical and mental health, social well-being and cultural survival. Professionals that may be involved in the EIA process could include public health inspectors, public health engineers, psychologists, social scientists, anthropologists, public health nurses, medical officers of health, environmental health physicians, health physicists, epidemiologists and toxicologists.

#### Definitions for Flowchart

Agent - A physical, chemical, biological agent or ergonomic concern; a mixture of agents, a situation or event (e.g. the building of a road).

Magnitude of Effect - Includes number and severity, or probability X consequence.

#### 1.2 ISSUES

The issues identified by the scientific/technical working group are categorized into several groups linked to the flowchart.

#### General

- a) Where should the demand for the inclusion of health effects information in EIAs originate? Should it be incorporated into legislation? What should be done in the lag before legislation can be updated?
- b) There is a lack of epidemiologists, toxicologists and other health professionals with the skills required to conduct health assessments for EIAs.
- c) Environmental epidemiology has a low priority in medical faculties
- d) There is a need for increased communication amongst those professions that would be involved in the health effects portions of EIAs.

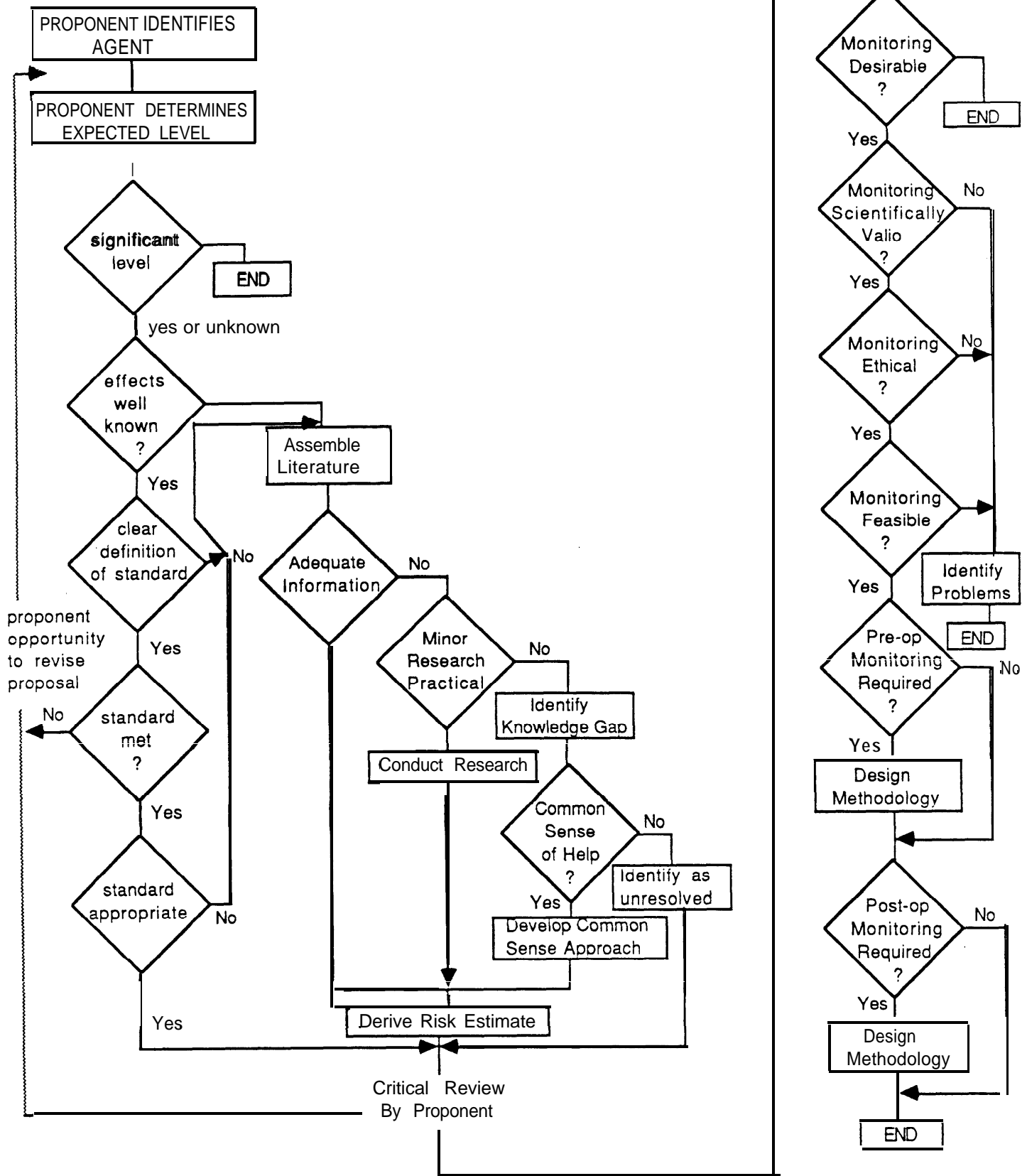
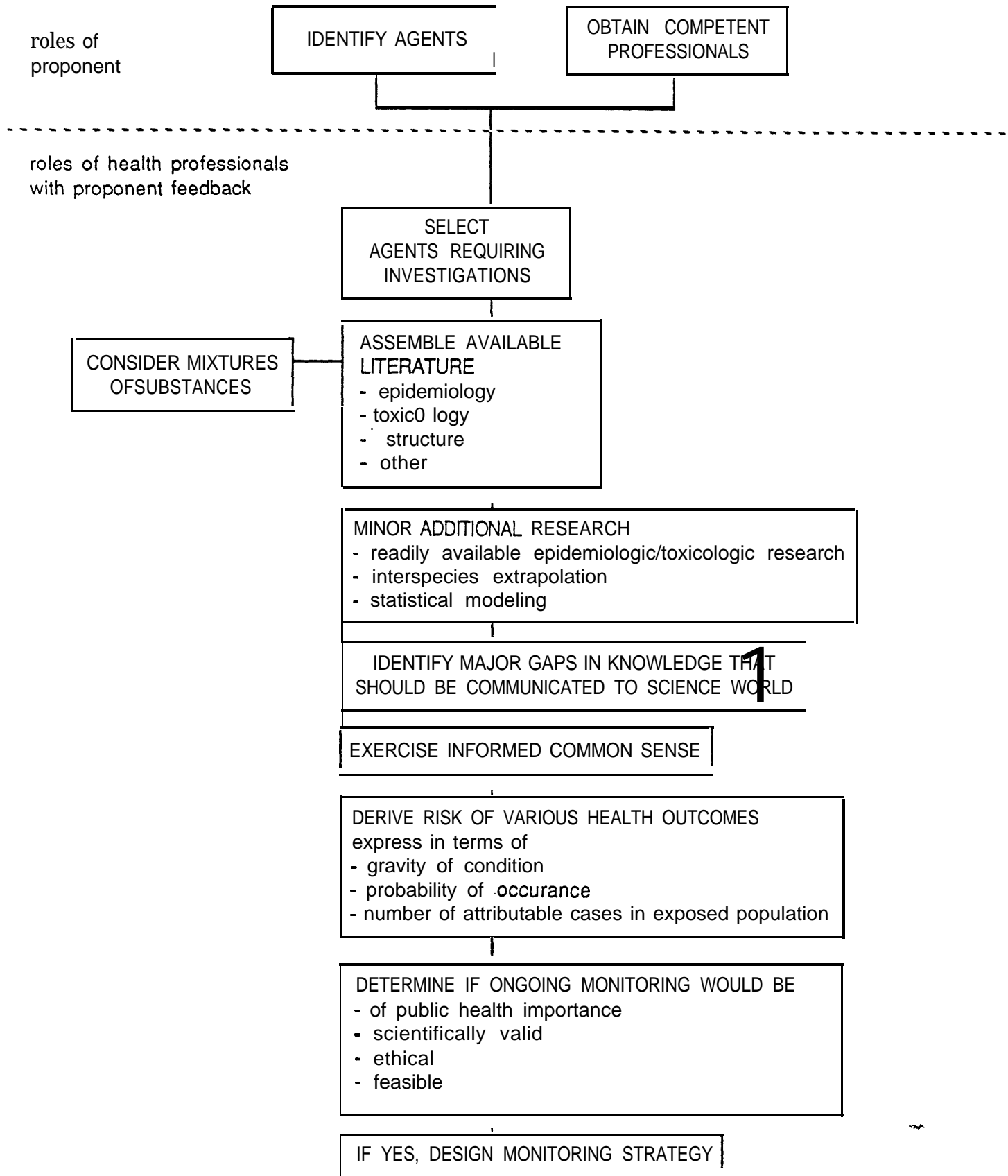


Figure 5. Process for the incorporation of the public health consideration into an environmental impact assessment.



\*Minimum requirements: epidemiologic and toxicologic expertise

Figure 6. Supplementary flowchart emphasizing scientific and technical issues in the assessment of physical and chemical hazards provided by J. Siemiatycki.

The agent

- a) There is a bias to include those agents in the EIA process for which the best information on health effects and analytical methodologies are available. It is difficult, if not impossible to study the potential risks associated with agents that cannot be measured.

Significance of level

- a) When an evaluation of environmental inputs is made, consideration must be given to current background levels. The site specific situation may cause an incremental increase over the background exposure.

Assembly of literature

- a) The data available to assess health effects are rarely perfect, and a best effort must be made to predict potential risks to health in preparing the EIA.
- b) There is a lack of access to some national and international literature.

Adequacy of information

- a) There is a vast amount of data on both morbidity and mortality that could be used for an EIA, if it was in a more accessible form.
- b) Studies that show negligible health effects are difficult to get published but are useful in the EIA process. Such information may be very difficult to locate.
- c) Industry is reluctant to publish material that may be used by competitors.
- d) Present systems of data collection may be inadequate to be used confidently in epidemiological research.
- e) Information should be accessible where it is deemed vital to the protection of public health.

Identification of knowledge gaps

- a) Epidemiological data bases frequently do not exist when needed. Toxicological data are somewhat more available, but also are often inadequate.
- b) Background data on human health effects of agents in the environment are not site specific, however, may not need to be (i.e. general health effects data can be extrapolated to site specific situations).
- c) It is not important to know what happened in the area to be disturbed during the distant past in order to predict what may happen in the future.
- d) There is not sufficient research in some areas to support EIAs presently being done. It is not clear who has the foresight or responsibility to determine what research needs to be done.
- e) Is it the responsibility of the proponent or the research granting agencies to sponsor research in the areas where information is lacking? If this is a matter of scale, who determines the responsibility of conducting the research.
- f) There is reluctance by proponents to support research as it places them in the position of appearing responsible for any unfavorable results observed.

The conduct of research

- a) New methodology is needed in order to answer questions concerning low frequency effects in small populations.
- b) There is a need for improved understanding of the relationships between effects of agents in vitro systems, laboratory animals and humans.
- c) In areas where there is low population density, it is difficult to determine the health effects on the small population, even if the project may cause significant environmental impact.

Derivation of risk estimates

- a) There is poor understanding by the general public of the scientific meaning of risk.

Standardization

- a) Guidelines are under constant revision and updating, therefore, are moving targets for the EIA process.

Baseline data collection

- a) Some individuals are concerned that the project may go ahead before baseline data are all obtained.
- b) A company should not have to delay its project to collect information when no health effects are expected.
- c) It is not always necessary to know the health effects of an agent when its concentration or overall exposure is below background levels, or when an increase in the level of the agent in the environment may be less than natural fluctuations.

Monitoring

- a) There is a need to improve the effective utilization of data collected from the ecosystem in the assessment of health effects.
- b) There is poor communication between those measuring environmental effects and those measuring public health effects, and interpret and communicate them to the general public.

## 1.3 RECOMMENDATIONS

- 1) Existing health information should be organized in a more readily usable form.
- 2) Those reviewing EIAs should communicate with granting agencies the areas identified in the EIA that require further research.
- 3) The improvement of facilities for developing expertise in health sciences should be supported to provide training, research and communications with other scientific disciplines involved in the EIA process.
- 4) Long term, broad based research projects should be encouraged on a variety of agents in a variety of locales.

- 5) **The data base available** on the utilization of surrogate indicators of the potential effects of agents on humans (e.g. in vitro systems, laboratory animals, various ecological systems) should be improved.
- 6) **Indicators** selected for monitoring health effects must have high sensitivity and specificity, be cost effective, **scientifically** valid, measureable, ethical, and feasible.
- 7) A list of indices for the general monitoring of health effects should be developed to provide data for EIAs.
- 8) There should be de *minimus* values defined for various agents (e.g. is the value above or below background).
- 9) Expertise in evaluating health effects in the EIA process should be shared with other nations and jurisdictions.
- 10) If the available data are inadequate to enable the proper assessment of health effects, various modelling, structure-activity relationships, etc. should be utilized to provide best-estimates. Further research is desperately needed in these areas.

#### 1.4 ACTION ITEMS

- 1) Suggest to the granting agencies that their priorities be evaluated with a view to generating research in those areas of the EIA process where need has been identified.
- 2) Retain and expand various data base systems (e.g. the CANOLE data base currently provided by CSTI) to include all internal government documents on potential health effects of agents.
- 3) In order to overcome current deficits in qualified personnel, expertise could be obtained from other countries on a consulting basis (e.g. U.S., Europe, U.K., Australia).

## 2. WORKING GROUP ON PROCEDURES

FACILITATOR: G. BEANLANDS

### 2.0 INTRODUCTION

The group interpreted "procedures" as the means whereby individual health professionals could be encouraged to become involved in environmental impact assessment (EIA). As such the institutional constraints to such involvement were not the focus, but rather the mechanisms required to achieve optimum input from the health professionals.

The group also recognized that not all members of the health professions had potentially equal roles to play in EIA. For example, physicians working in a clinical setting may have a limited role to play in EIA since they deal primarily with individuals who are in immediate need of medical attention. More relevant perhaps to EIA are those sectors of the health professions that work at the population level and are focussed on predicting future health needs, i.e. epidemiologists, toxicologists, hygienists, occupational health experts and public health officials.

To facilitate a more structured approach to the problem, three basic components that had to be addressed were recognized - the need for a policy framework, the need for an effective working relationship (linkage) between members of the EIA and health communities, and the crucial importance of follow-up activities. The report is organized around these components while incorporating the outline which was given to us as a reporting framework.

## 2.1 ISSUES

### Policy Issues

- a) There is an inadequate involvement of health professionals in EIA in Canada. The reasons for this are not immediately apparent since the importance of such involvement seems obvious and there are no technical reasons why the expertise should not be available.
- b) In general, current EIA policies do not promote the involvement of health professionals. Within this working group there was no knowledge of any EIA process in Canada which required the consideration of health factors. There was a consensus that if such involvement was going to occur spontaneously, it would have done so by now. Therefore, it was decided that a requirement in policy would be an effective way to bring about such involvement.

The group recognized a number of difficulties that would have to be overcome in developing an effective policy in this regard, but did not consider any of them to be insurmountable:

- a) The policy will have to be sensitive to the historical split between departments of environment and health within governments and the allocation of responsibilities for health between levels of government.
- b) At a strategic level roles and responsibilities will have to be determined in a way that results in a fair and equitable distribution of work and resources among professionals at all levels in the health community, i.e. from federal to municipal levels.
- c) The policy will have to account for the fact that different health professionals may be required at different stages in the EIA process, from developing terms of reference to monitoring for health effects in the field.
- d) The various health professional associations have a role to play in the strategy which is mounted to have this policy initiative adopted by various governments.
- e) Any policy developed should be grounded in the right of individuals to know of risks to their personal health and safety.
- f) Given that health delivery systems in Canada are probably working near to capacity now, any policy initiative should recognize the need for additional financial resources.

### Conclusions

In spite of the potential problems mentioned above, the most effective way to bring about a greater involvement of health professionals in EIA is through policy initiatives.

### Linkage issues

The group used this term to refer to the need for coordination among the EIA and health professionals in the various activities involved in actually conducting an EIA. The focus was on working relationships, assuming that an appropriate policy was in place.

- a) Health professionals are generally ignorant about EIA and the potential roles they may play.
- b) The involvement of health professions could introduce certain constraints into EIA studies.
- c) There is a wide variety of potential roles and responsibilities for health professionals in EIA and it will be necessary to define needs on a case-by-case basis.

In developing effective linkages with health professionals, certain key points will have to be kept in mind. The group identified the following although the list is not meant to be complete:

- a) An education program will need to be mounted to develop an awareness among health professionals of the state-of-the-art of EIA in Canada.
- b) The health professionals will have to be given an opportunity to become involved in developing the terms of reference for EIAs as well as the scoping process.
- c) The question of the personal liability of health professionals involved in EIA will have to be determined in case it represents a problem.
- d) It will be critical to involve the local health professionals from the area to be impacted in the design, execution and follow-up of EIA.
- e) Any involvement of the health professionals in EIA will have to give due consideration to the ethical questions related to working with human subjects, and the effects on timing of studies and the availability of the results.
- f) The group felt it important to highlight the potential advantages to the health community through their involvement in EIA including the opportunity to use the existing administrative structures to develop standardized information sources and to gain access to important environmental data of which they might otherwise be unaware.

#### Conclusion

There is a need for the development of communication and working relationships between the EIA and health communities, involving the relevant health professions in all aspects of EIA design, implementation and interpretation.

#### Follow-up issues

Although the group recognized that follow-up activities such as monitoring and auditing are integral aspects of assessment and are automatically included under "linkages", they felt that the entire field of follow-up activities was important enough to be dealt with in its own regard.

- a) It is imperative that environmental and human health data be integrated in monitoring programs undertaken under EIA.
- b) It is unlikely that existing health records will provide the necessary information for monitoring of health effects from development and, therefore, the involvement of health professionals will necessitate an expansion of monitoring programs.
- c) Dealing with human subjects raises difficulties with regard to access to data at the individual level due to limitations imposed by confidentiality.

Perhaps the most important point to be made with respect to the involvement of health professions in the follow-up studies in EIA is the benefits to be gained by having both professional groups working together. For example, the EIA community could benefit by having the focal point of health to consider in scoping, and the health community could participate in the design of studies which could provide them with environmental indicators that are so important in toxicological and epidemiological studies. In the final analysis, the people potentially effected by a proposed development will be better served by an integrated approach to monitoring.

#### Conclusion

The involvement of health professions in follow-up studies to EIA is crucial to protecting the health and welfare of people and every effort should be made to provide adequate resources



in the EIA to ensure that health professionals can undertake their roles and responsibilities in a timely manner.

## 2.2 RECOMMENDATIONS

### Policy

FEARO, DOE and H&WC, in cooperation with the provinces, should develop an integrated strategy leading towards the development or modification of EIA policies so that health professionals would become involved. In the development of such a strategy, CEARC and professional health associations should be asked to contribute.

### Linkage

The agencies which eventually become involved in the development of the above-mentioned policy should establish a task force made up of people from both the EIA and health communities to work out appropriate mechanisms to optimize the communications and working relationships with regard to their involvement in EIA studies. These working relationships should cover all aspects of EIA from design to implementation of results.

### Follow-up

The agencies participating in the development of the above-mentioned policy initiative should support a study to define the most appropriate way to optimize the cooperation of the EIA and health professionals in monitoring. This could include such topics as the sharing of data bases, cooperative analysis and interpretation, development of sampling protocols, agreement on archival standards and information retrieval systems, and cooperation in post-development audits to determine the effectiveness of health studies in EIA.

## 2.3 ACTIONS

- a) The planning group for the workshop should remain together as a body to plan a strategy for the implementation of the key recommendations arising from the workshop.
- b) The results of the workshop should be given wide circulation among the EIA and health communities.
- c) EIA as a topic should be covered in various newsletters published by health professional associations.
- d) FEARO/CEARC perhaps in conjunction with CPHA, should organize and conduct training sessions on EIA for members of relevant health professions.
- e) FEARO/H&WC should contract with CPHA to develop an inventory of health professionals across Canada who have the training and experience to participate in EIAs.
- f) FEARO/H&WC should contract a study to determine the potential problem of liability facing health professionals involved in EIA in Canada.

### 3. WORKING GROUP ON JURISDICTIONAL/INSTITUTIONAL ASPECTS

FACILITATOR R. ORFORD

#### 3.1 ISSUES

a) Public Health Concerns

A lack of integration of environmental and public health concerns, with the policies and planning of economic and resource ministries.

b) Health Subordinate

The whole concept of EIA needs to be re-examined if public health considerations are to be included--need to involve public health jurisdictions by giving them integral role in EIA (change EIA to EPHIA)--make public health jurisdictions share responsibility and accountability with current EIA jurisdictions (i.e. equal partnership).

c) Community Health Data

The lack of appropriate community health data diminishes the ability to contribute to the EIA process.

d) Long Term Effects

There is a lack of commitment to long term health concerns in the EIA process.

e) Resource Limitations

The role of health professionals and agencies is restricted by resource limitations (e.g. if health is a major issue, there must be more resources in that area).

f) EIA Definition

The definitions of EIA are perceived differently by various jurisdictions (e.g. environmental health = "health of the environment" versus "effects of the environment on human health"). Some definitions exclude health.

#### 3.2 CONCLUSION

1. There is a need to integrate both environment and public health policies in the planning by economic and resource ministries.
2. Health jurisdictions are not sufficiently involved in EIA.
3. There is a lack of community health data in EIA
4. There is a need for assessment of long term health effects to be included in EIA.
5. Resource limitations are preventing the conduct of necessary health studies.
6. There is a need for commonly accepted definitions of EIA and health.

#### 3.3 RECOMMENDATIONS

- 1) In order that Canada can pursue sustainable socio-economic development for the foreseeable future, economic and resource agencies must ensure environmental and public health concerns are taken into account at the earliest planning stages.

- 2) Environment and health jurisdictions should be equal partners in EIA.
- 3) Federal and Provincial EIA mechanisms should reflect the importance of community health data and develop compatible protocols for data collection and dissemination through accessible data bases, for use by the EIA community.
- 4) Guidelines should be developed and used for the identification of long term health effects. The EIAs should specify long term monitoring and assessment mechanisms to be used.
- 5) Health studies and long term monitoring must be adequately funded.
- 6) The CEARC definition of EIA and the WHO definition of health should be adopted.

### 3.4 ACTIONS

- 1) To accomplish this, governments should establish appropriate intersectoral mechanisms.
- 2) FEARO and the provincial EIA agencies should recommend the appropriate legislative and policy changes to the senior policy planning units of their governments.
- 3) Health and Welfare Canada should lead a Federal/Provincial joint effort to develop a national protocol for the collection of community health data and its dissemination through accessible data bases for the use of the EIA community. Local health officials should be trained in the collection and use of community health data for this purpose.
- 4) Health and Welfare Canada should develop an assessment of the problem of identifying the long term health effects associated with environmental impacts.
- 5) EIA agencies should include the funding of health studies by appropriate health institutions in their annual budgetary process in order to reflect the needs of the EIA community.
- 6) FEARO should promote the adoption of a Federal/Provincial acceptable definition of EIA and Health for the use of the EIA community through the appropriate Federal/Provincial mechanisms.

## 4. WORKING GROUP ON SOCIO-POLITICAL ASPECTS

FACILITATOR: H. VERSTEEG

### 4.0 INTRODUCTION

The goal of our present task is to improve the health of Canadians by ensuring the appropriate addressing of public health considerations in the environmental impacts assessments utilizing the objective as outlined in the workshop mandate.

It was agreed by our group that the definition of Environmental Impact Assessment offered in the CEARC publication "Learning from Experience" would be suitable for our purposes.

It was further agreed that the "Public Health Community" (PHC) would be representative of any organization or individual that has an active interest in public health.

### 4.1 PRINCIPLES

1. A public health component must be included in the EIA process.

2. **Public participation** (including public health participation) at some stage in the process is essential.
3. The process **must** provide a rationale, including the criteria involved in the evidence used in arriving at a decision.
4. There must be public access to the information. It must be comprehensive and comprehensible.
5. The process must be dynamic.
6. The Public Health Community has a responsibility to articulate and communicate public health issues - there is a clear obligation to educate the public.
7. The PHCs have an obligation to protect public health (present and future) at the macro level.
8. All activities should be designed to maximize efficiency.
9. The process must be fair, balanced and comprehensive.

#### 4.2 PROCESSES

Following the development of the principles, it was agreed that a focus would be made on “activities” that assessed environmental impact. These “activities” were to include a health component. In delineating activities, two primary assumptions were made:

- 1) some EIA processes include adequate health components;
- 2) some EIA processes do not include adequate health components;

Our efforts then lay in the direction of assessing activities falling under the second assumption, from a socio/political perspective, within the guidelines offered by the three Workshop Objectives.

The working group began its task by listing, in random order, the socio/political principles that should be adhered to in any activity with an environmental component. Following identification of the major activity areas playing a role in environmental impact assessment, two paradigms were developed for each identified activity. These paradigms were based upon the workshop objectives and socio/political perspectives area as follows:

- 1) model (ideal) world: and
- 2) practice (real) world.

In other words, our concern was not with the socio/political content of an EIA. Our concern was, however, to ensure that socio/political principles would be included in each major activity which has an environmental component with significant potential health impact. We felt this would be accomplished efficiently through:

- 1) a delineation of socio/political principles - by no means exhaustive;
- 2) a listing of major activities by category (i.e. not specific EA projects, except by example);
- 3) the creation of “ideal world” models to ensure the reflection of public health considerations in each type of process, and outline the roles and responsibilities of PHCs in the process;

- 4) the creation of "real world" models to illustrate how PHCs should work to improve public health content in EAs to the greatest extent practicable, given real world flaws and limitations; and
- 5) recommendations and potential actions.

This method of activities, models and recommendations is outlined in the following chart. Please bear in mind that the framework is to be used within the parameters of the workshop objectives and our socio/political principles.

It was felt by our group that it is necessary to explore the process options when addressing the issue of public health components in assessments of environmental impact. It is suggested that these processes be pursued in descending order, following prioritization of these processes.

In a real world system that does not work efficiently, the following approach may, for example, be taken in an exploration of options:

1. political/bureaucratic process
2. media
3. environmental ombudsman (explore possibility)
4. self-assessment
5. court
6. other environmental councils

In returning to our goal to improve the health of Canadians by insuring the appropriate addressing of public health considerations in assessments of environmental impact, we feel we have offered a practical framework within which to address this issue.

Figure 7. Socio-political aspects of different types of EIAs.

Major Activity	1. Non-Statutory EAs	2. Statutory EAs e.g. EARP	3. Courts, e.g. e.g. Ont EAA Nova Scotia Herbicide Trial	4. Public Hearings e.g. Pearse Commission	5. Regulatory Actions e.g. H & W Canada's risk assessment for pesticides	6. Political e.g. Alachor Decision
Paradigm One: Ideal World	Statutorily codify to ensure socio/political perspectives: e.g. public access to assessors; appeal mechanism, public input.		<ul style="list-style-type: none"> <li>not used because the conflict between law and science is not resolvable</li> <li>too expensive and adversarial</li> <li>inappropriate forum</li> <li>possibility of an environmental court</li> </ul>	<ul style="list-style-type: none"> <li>mandate is to collect information and sometimes recommend</li> <li>usually not designed to make a decision</li> <li>general public is made more aware of issues</li> <li>good notice provision and call for briefs</li> </ul>	<ul style="list-style-type: none"> <li>information flow and cooperation among federal agencies, and between federal and provincial agencies</li> <li>criteria for assessment is public</li> <li>rational for assessment is comprehensive and public</li> <li>public involvement prior to final approval</li> </ul>	honesty in the rationale for decisions politician takes the leadership in decision-making direct access
Recommendations	coordinate with other NGOs PHCs to become conversant with process and lobby process (c.f. Political Activity)		Court is the last resort due to conflict between law and science. Must explore options for resolution.	PHCs must participate in this process because of the opportunity to educate the public on health issues.	<ul style="list-style-type: none"> <li>choose causes carefully and aware of material</li> <li>PHCs require an intimate understanding of bureaucratic process and must target key federal/provincial bureaucrats</li> <li>cooperation with minister's constituents</li> <li>consideration of lobby activity</li> <li>rights to appeal the final regulatory decision</li> </ul>	
Paradigm Two: Real World	PHC obligation to become informed of real world process, including key players for contracts assess how and to what extent PHCs will become involved in particular issues. PHCs will establish, within (their own organization, responsibility centres	PHC responsibility monitor legislation participation and input to the extent allowed and agreed to by PHCs to the extent that the legislation is breached, consideration of lobbying activities by PHCs	<ul style="list-style-type: none"> <li>PHCs to train members in legal principles and court-room tactics</li> <li>PHCs must take into account ethical considerations</li> </ul>		There is no existing paradigm; therefore recommendations are based upon an imperfect system.	- PHCs must lobby in an effective manner, taking into account political expediency

## RAPPORTEUR'S SUMMARY

This concluding statement summarizes the key points which satisfy the objectives rather than attempting to synthesize all issues, conclusions, recommendations and actions.

The objectives described at the opening of the workshop were:

1. To incorporate public health considerations into environmental impact assessment in Canada;
2. To determine roles and responsibilities for achieving greater involvement of health professionals in environmental impact assessment activities;
3. To identify mechanisms for developing stronger operational and research links between the EIA community and relevant health professions;

The workshop began with a keynote address by David Bates identifying, from his experience, issues which can interfere with a preventive and participatory approach to the assessment of the ecological and health impacts of development activities. These activities include uranium mining, nuclear power, asbestos and lead in the environment. This was followed by commentaries in which there was consensus developing on several points. These points are described under each of the sections below. Case studies were used from Canada, Mexico and Europe to understand how health issues have been addressed and how health professionals have been involved. Ian Waddington's paper describing the WHO environmental health impact assessment process gave reason to believe that a change in the current Canadian approach was indeed possible.

On the second day working groups began to delve into and further define the issues. That process was definitely facilitated by the representation from various disciplines, various interests and various jurisdictions and the fact that participants were willing to accept reasonably broad definitions of EIA and health.

### OBJECTIVE 1.

The first objective, to incorporate public health considerations in EIA has perhaps more of a political and policy nature.

There was consensus in all groups EIA in most jurisdictions and in most instances is deficient because the health impacts are not assessed and health professions are not contributing to the process. We have seen examples in the nuclear industry where many of the concerns were addressed and other studies such as those on sour gas in Alberta or asbestos in Ontario which have emphasized health impacts almost exclusively.

There is either a policy vacuum regarding the involvement of health matters or a need for a policy change in which health impacts are clearly considered as being within the realm of environmental impacts. One means of achieving this could be to use the term environmental health impact assessment.

As an action item, negotiation should be initiated with the senior policy-planning offices of the federal, provincial and territorial governments to ensure that changes are made in policies, Cabinet Directives, Orders in Council or whatever document or decision has limited the health aspect. However, it should be recognized that requiring the health aspects to be incorporated will not automatically result in an improved process or better outcomes, unless other actions are also taken.

- i) There is a need to increase the education and training of environmental health professionals in Canada. More toxicologists and especially epidemiologists are required to provide the data base on which interpretations of risks can be made. A plan of action must be developed to

meet the requirements if EIA managers expect health professions to participate more fully in the future.

- ii) The Working Groups argued for more health effects data. It appears that there is a large amount of existing data which could be more useful if it was more accessible, if it was organized differently in data bases, and if some health and environmental data were linked. Before this latter is attempted, managers must ensure that they know why the data is being gathered. More specifically, community health data bases are required as baselines against which the health impacts of a project can be compared.

Research in several areas is needed including better, animal models, health effect indicators, thresholds, and studies on long term health effects of multiple exposures. We should also recognize that some necessary data especially that of an epidemiologic nature will take a long time to collect.

It may be that the health aspects need not be incorporated in a particular EIA. There is a need for continuing debate on the weight might be given to factors which trigger a decision to incorporate health studies. These include:

- public pressure based on perception
- data generated by retrospective studies from other jurisdictions
- a legislated requirement to include health
- a careful analysis of the need to predict potential health impacts based on information about agents

Several participants urged that these potential impacts should be translated into risks and benefits so that the degree of uncertainty becomes more explicit. This may be more important for health than ecological impacts because of the socio-political nature of health issues. There is a cost to all of this, particularly in the short to medium term but better environmental planning and the EIA emphasis on prevention should provide greater benefits in the long term.

## OBJECTIVE 2.

The second objective emphasized roles and responsibilities of various parties. Key players identified by the different working groups included educational institutions; EIA management agencies e.g. FEARO; health agencies, notably Health and Welfare Canada; associations of health professionals, e.g. CPHA, CMA.

- i) Educational institutions, especially universities, have a role in developing the programs and structures by which a larger number of environmental health professionals are graduated. It was argued that it would be beneficial if MDs were given more education in this area, especially those who will have greater community responsibilities.
- ii) EIA agencies must initiate discussion with health agencies and senior offices of governments to ensure that policy changes are made. They can also pointedly disseminate more information to health associations about EIA in general or about specific EIA's.
- iii) Health agencies, at the federal, provincial and local levels are very important in facilitating the incorporation of health aspects in EIA. For example, at the federal level, Health and Welfare Canada can support more research in this area through NHRDP and should strive for greater collaboration with other granting agencies, e.g. CEARC.

A cooperative federal/provincial effort should be mounted to develop a national protocol and program for community health data bases. In fact, the whole issue of health data bases is obviously a primary responsibility of health agencies but if linkages are pursued as recommended, then others such as Departments of Environment also share the responsibility. WHMIS is perhaps a good beginning.



More than one working group stressed that local health officials (e.g. medical health officers) have a very important role to play in site specific impact assessment. Unfortunately in some jurisdictions, there are institutional barriers. Health agencies at the provincial level in particular must facilitate that participation, at the simplest level by letting these officers know about an EIA being initiated and that they can become involved.

- iv) Last but not least is the public or environmental health community - the individual and their associations. Working groups clearly placed a responsibility on them to develop a greater awareness of EIA - type planning and decision-making processes, and to become involved in those processes. This could occur by identifying responsibility centers within health associations for matters relating to EIA in general, emphasizing the development of policy and process, in addition to matters related to site specific EIA. More parochially, CPHA members with EIA experience should be encouraged to become more involved in the affairs of the Occupational and Environmental Health and Safety Division of the Association. As pointed out by working groups, the term health professions is too comprehensive because all disciplines and associations will not necessarily be involved in all stages.
- v) It was recognized that EHIA inherently requires a multidisciplinary approach even in such areas as radiation-related projects where traditionally one type of health professional has played a primary role.
- vi) A final point which came out on several occasions, is that a greater degree of communication and information transfer between current players and the potential health players. The "sentinel physician" system was suggested as one means of enhancing information transfer among health professionals.

### OBJECTIVE 3.

The third objective tasked participants with identifying mechanisms for developing stronger operational and research links. Many of these mechanisms have already been mentioned but a few are highlighted here because they may be appropriate for early discussion by a follow-up committee:

- i) Appropriate intersectoral mechanisms must be developed so that sustainable development can be pursued. While not limited to interagency committees or referral systems, some improvement is required there. For example, at the regional level in the federal government, Health and Welfare Canada should become members of Regional Screening and Coordinating Committees (now comprised only of Environment and Fisheries and Oceans personnel) which review, if very cursorily, all development projects funded by the federal government.
- ii) Federal/provincial cooperative mechanisms must be put into place under the aegis of existing structures, to create national protocols for the collection and organization of community health data and the accessibility of that data.
- iii) Some forum might be convened bringing together environmental health professionals, especially epidemiologists, to discuss ways and means of increasing the numbers of such professionals, the types of structures, whether national or more local, to achieve that goal and funding approaches to generate the required studies.
- iv) A study was recommended by the procedural group to define the most effective way of bridging EIA, biophysical and health professionals. Several topics were identified for such a study. This work should be initiated as soon as possible.
- v) Training programs on EIA for health professionals which could be offered through associations such as CPHA, and Continuing Education Departments of Universities. A review of the course to be held on Aberdeen, Scotland in September 1987 should be undertaken

with the intent of modifying it for use in Canada. Other similar courses should also be reviewed.

As a group, we should be mindful that we all want improvement of the health and well-being of Canadians and that EIA is one such process and tool for achieving that objective. There was also consensus that the EIA process managers should always strive to ensure that issues of a multidisciplinary and multijurisdictional nature can be addressed in an open and fair manner. The final recommendation made by participants, that a committee should be established to follow-up on the specific recommendations of the working groups, is a positive step toward that objective.

**APPENDIX I****ABBREVIATIONS**

AECEB	Atomic Energy Control Board
CANOLE	Canadian Online Enquiry System
CEARC	Canadian Environmental Assessment Research Council
CMA	Canadian Medical Association
CPHA	Canadian Public Health Association
CPRA	Canadian Radiation Protection Association
CSTI	Canada Institute for Scientific and Technical Information
EAA	Environmental Assessment Act (Ontario)
EIA	Environmental Impact Assessment
EH	Environmental Health
EHIA	Environmental Health Impact Assessment
EARP	Environmental Assessment Review Process
FEAR0	Federal Environmental Assessment Review Off ice
H&WC	Health and Welfare Canada
IAEA	Ingernational Atomic Energy Agency
ICRP	International Commission for Radiological Protection
NHROP	National Health Research and Development Program
PHC	Public Health Community
SARH	Ministry of Agriculture and Water Resources (Mexico)
SEUSA	South eastern edge of the Upper Silesian Agglomeration
WHMIS	Workplace Hazardous Materials Information System
WHO	World Health Organization

**APPENDIX II****GLOSSARY**

Area-Wide Review - includes a number of proposals for a large area which may be at different stages of planning or based on different levels of scientific knowledge.

Boundary - a limitation conferred by space, time, ecology, as well as political, social or economic factors.

Class Assessment - standardized environmental assessment guidelines to direct the required environmental assessment activities for a class of projects.

Compensation Measures - payment in fund or replacement in-kind for losses attributed to a development; funds being used to recreate lost habitat (for example, artificial spawning beds) or other valued resources.

Cumulative Impacts - the combined effects of components of a development or a series of developments and other activities occurring either simultaneously or sequentially, or in an interactive manner.

Ecosystem - a community of interdependent plants and animals together with the environment which they inhabit and with which they interact.

Environmental Design Review - Focuses on the appropriate environmental terms or environmental design parameters that should be used to keep adverse impacts at a minimum.

Environmental Impact - the net change, positive or negative, in human health and well-being, that results from an environmental effect including the well-being of the ecosystem on which human survival depends.

Environmental Impact Assessment - an activity designed to identify, predict, interpret, and communicate information about the impact of an action, on human health and well-being, including the well-being of ecosystems on which human survival depends.

Environmental Impact Statement - a documented assessment of the environmental consequences and recommended mitigation actions of any proposal expected to have significant environmental consequences, that is prepared or procured by the proponent in accordance with guidelines established by a Panel.

Exclusion - a project type with little or no impact on the environment, either individually or cumulatively, and which is not controversial, in which case initial assessment is not required and the project type is entered on a departmental exclusion list.

Generic Review - held very early in planning for a range of proposals dealing with new concepts or technologies.

Impact - see Environmental Impact.

Initial Assessment - an environmental investigation of a proposal and its alternatives to determine on a preliminary basis whether, and the extent to which, there may be any potentially adverse environmental effects. Initial assessment includes the stages of screening and any additional environmental investigations needed to reach an initial assessment decision.

- Initial Environmental Evaluation (IEE) - is the documented result of investigation needed to address unknowns associated with the impacts or mitigation possibilities of the proposal under review which are impeding an initial assessment decision.
- Initiating Department - any department or agency that is, on behalf of the Government of Canada, the decision-making authority of a proposal in the context of the Process, including those with funding responsibilities or with responsibilities for land, water, or natural resources.
- Issue - an unresolved question or concern about an environmental impact, consequence or effect.
- Mitigation - an activity aimed at reducing the severity, avoiding or controlling environmental or social impacts of a proposal, through design alternatives, scheduling, and other measures.
- Monitoring - data collection and evaluation of environmental parameters or processes, for the purpose of:
- (1) determining the efficiency of environmental protection measures, including the reporting on the adequacy of project impact prediction methods and mitigation measures;
  - (2) developing capability for future projects;
  - (3) improving on project management and planning and related programs to better protect the environment.
- Order in Council - approval given on June 21, 1984, by the Government of Canada to guidelines respecting the implementation of the federal policy on environmental assessment and review.
- Panel - a multi-disciplinary group, usually of 3 - 6 individuals, appointed on the basis of expertise and objectivity, to evaluate, through public hearings and study, the potential environmental impact of a proposal referred to the Minister of the Environment for review.
- Prevalence - the number of incidences or locations of a type of impact that may occur in a given area.
- Process - the Environmental Assessment and Review Process of the Government of Canada.
- Proponent - the organization, company, or the department planning to undertake a proposal.
- Proposal - any program, activity or project for which the Government of Canada has a decision-making responsibility.
- Public Hearing - an open public forum held by an environmental assessment panel to gather facts and concerns during a public review of a proposal.
- Residual Impacts - those predicted adverse impacts which remain after mitigating measures have been applied.
- Scoping - a process by which the important issues and alternatives that should be examined in environmental impact assessment are determined.
- Screening - a component of initial assessment which categorizes proposals according to one of eight possible decision routes established under the EARP.

**Significant Issue** - an issue for which there is a high probability that one or more impacts connected with that issue will exceed a threshold of concern such that a public review by Panel is required to address the issue.

**Supervision** - a continuous overseeing of a project by qualified staff hired by the proponent during the project implementation to see that the project is built according to environmental specifications.

**Surveillance** - field inspections undertaken or sponsored by a government agency to ensure that a company and its contractors are complying with the environmental terms and conditions applied to a project, and to provide timely reaction to unexpected developments or unforeseen design changes with environmental implications.

**Valued Ecosystem Components** - the environmental attributes or components identified as a result of a social, scoping exercise as having scientific, social, cultural, economic or aesthetic value.

Reference: FEARO, 1986, 1987

**APPENDIX III**  
**PARTICIPANTS**

**Dr. Mauricio Athie (PAHO), Senior** Environmental Advisor, Banco Centro Americano De Integracion, Economica, Honduras, Apartado Postal 772, Tegucigalpa HONDURAS

**Mrs. Annie Banksland**, Chairperson, Inuvialuit Board, Inuvialuit Social Development Fund, Box 2120, Inuvik NWT XOE OTO

**Dr. David V. Bates**, Professor of Medicine, Department of Medicine, Acute Care Hospital, Room S-105, University of British Columbia, 2211 Wesbrook Mall, Vancouver, BC V6T 1 W5

**Dr. Gordon Beanlands**, Director of Research, Federal Environmental Assessment Review Office, 1318 Robie Street, Halifax, NS B3H3E2

**Mr. John W. Beare**, Director, Regulatory Research Branch, Atomic Energy Control Board, Mattel Building, 270 Albert Street, P. O. Box 1046, Ottawa, ON K1P 5S9

**Mr. Allan Bierbrier**, Associate Executive Director, Canadian Public Health Association, 1335 Carling Avenue, Suite 210, Ottawa, ON K1Z 8N8

**Dr. Raymond Brouzes**, Director, Environmental Affairs, Alcan Aluminum Ltd., 1188 Sherbrooke Street West, Montreal, PQ H3A 3G2

**Dr. Carol Burnham**, Manager, Technology Applications, Canadian Fusion Centre, 2700 Lakeshore Road W., Mississauga, ON L5J 1K3

**Dr. Ian Burnham**, Manager, Health Physics Department, New Brunswick Power, P. O. Box 2000, 420 York Street, Fredericton, NB E3B 4X1

**Mr. Raymond P. Côté**, Associate Director, School for Resource and Environmental Studies, Dalhousie University, 1312 Robie Street, Halifax, NS B3H3E2

**Dr. Kate Davies**, Acting Coordinator, Environmental Protection Officer, Department of Public Health, City of Toronto, 12 Shuter Street, Toronto, ON M5B 1A2

**Mr. Richard J. Davies**, Director, Division of Community Hygiene, Department of Health and Social Services, P. O. Box 2000, Charlottetown, PEI C1A 7N8

**Dr. Mostafa El-Desouky**, Technical Advisor, Environmental Protection Department, Ministry of Public Health, P. O. Box 35035, Safat KUWAIT

**Dr. Jacobo Finkelman**, Pan American Centre for Human Ecology, Pan American Health Organization, Apartado 37-473, 06696 - Mexico DF MEXICO

**Dr. Geoffrey Granville**, Manager, Toxicology and Material Safety, Shell Canada Ltd., 400-4th Avenue SW., Calgary, AB T2P OJ4

**Ms. Michelle Ivanitz**, Health Director, Inuvialuit Social Development Fund, Box 2120, Inuvik, NWT XOE OTO

**Dr. Don Johnston**, Occupational Health Consultant, Health Centre, 707 Coach Bluff Crescent S.W., Calgary, AB T3H1A9

**Dr. Rosemarie Marchant**, Occupational and Environmental Medical Consultant, 1020 Aird Street, Saskatoon, SK S7N 0T1

**Dr. Andre Marsan**, Consultant, 6100 Royal Mount Avenue, Montreal, PQ H4P 2R2

**Mr. Tim Meadley**, Uranium Section of the Saskatchewan Mining Association, c/o 817-825 45th Street West, P. O. Box 9204, Saskatoon, SK S7K 3X5

**Dr. Mary P. Measures**, Supervisor, Occupational Radiation, Protection Section, Radiation Protection Division, Atomic Energy Control Board, 270 Albert Street, P. O. Box 1046, Ottawa, ON K1P 5S9

**Dr. Robert Orford**, Deputy Minister, Alberta Community and Occupational Health, Government of Alberta, 10th Floor, Seventh Street Plaza, 10020-107 Street, Edmonton, AB T4J 3E4

**Dr. Nick Poushinsky**, Special Advisor to the Minister, Health Care Reform, Manitoba Health, Legislative Building, Room 346, Winnipeg, MB R3C 0V8

**Dr. M. Husain Sadar**, Scientific Advisor, Federal Environmental Assessment Review Office, 13th Floor, Fontaine Building, 200 Sacre Coeur Boulevard, Hull, PQ K1A 0H3

**Mr. Michael Scott**, Director of Communications, Ontario Waste Management Corporation, 2 Bloor Street West, 11th Floor, Toronto, ON M4W 3E2

**Mr. John Shaw**, Environmental Health Engineer, Environmental Health Alberta Community and Occupational Health, 5th Floor, Seventh Street Plaza, 10030-107 Street, Edmonton, AB T5J 3E4

**Ms. Maisie Shiell**, 2332 Atkinson Street, Regina, SK S4N 3X3

**Dr. Jack Siemiatycki**, Professor, Institut Armand Frappier, 531, boul. des Prairies, Laval des Rapides, PQ H7V 1B7

**Ms. Jennifer Simon**, Graduate Student, Faculty of Environmental Studies, York University, 3rd Floor, Lumbers Building, 4700 Keele Street, North York, ON M3J 1P3

**Dr. Emmanuel Somers**, Director General, Environmental Health Directorate, Environmental Health Centre, Health and Welfare Canada, Tunney's Pasture, Ottawa, ON K1A 0L2

**Mr. Jerry Spiegel**, Director of Planning, Research and Evaluation, Department of Environment and Workplace Safety and Health, 960-330 St. Mary Avenue, Winnipeg, MB R3C 3Z5

**Professor Hajo Versteeg**, Chairman, Pest Management Advisory Board, Vanguard Building, 171 Slater Street, Room 701, Ottawa, ON K1A 0C5

**Mr. J. Ian Waddington**, former Director, Environmental Health Services, World Health Organization, Regional Office for Europe (EURO), Scherfigsvej 8, DK-2100, Copenhagen DENMARK

**Mr. Robert H. Weir**, Chief, Environmental Impact Systems Division, Conservation and Protection, Department of the Environment, 15th Floor, Place Vincent Massey, Hull, PQ K1A 0E7

**Dr. Franklin M. M. White**, President, Canadian Public Health Association, 1335 Carling Avenue, Suite 210, Ottawa, ON K1Z 8N8

**Mr. Anthony Williamson**, Director, Don Snowden Centre for Development, Support Communications, Memorial University, St. John's, NFLD A1 B 3X5

**Dr. Robert F. Willis**, Senior Toxicologist, Can Tox Inc., 460 Wycroft Road, Oakville, ON L6K 2G7



Dr. Stan Winthrop, Senior Advisor, Environmental Health Directorate, Environmental Health Centre, Room 120, Health and Welfare Canada, Tunney's Pasture, Ottawa, ON K1A 0L2

## APPENDIX IV

WORKSHOP ON HEALTH ASPECTS OF  
ENVIRONMENTAL IMPACT ASSESSMENT

26 - 20 May 1987

Ottawa, Ontario

## WORKING GROUPS

## SCIENTIFIC/TECHNICAL

R. Marchant - Facilitator  
H. Sadar  
M. Measures  
M. El-Desouky  
J. Siemiatycki  
R. Willis  
T. Meadley  
J. Shaw

## PROCEDURAL

G. Beanlands - Facilitator  
R. Davies  
G. Granville  
R. Brouzes  
A. Williamson  
J. Finkelman  
N. Poushinsky  
D. Johnston  
J. Simon

## INSTITUTIONAL/JURISDICTIONAL

R. Or-ford - Facilitator  
J. Beare  
K. Davies  
A. Marsan  
A. Bierbrier  
I. Waddington  
S. Winthrop  
R. Weig

## SOCIO-POLITICAL

H. Versteeg - Facilitator  
J. Spiegel  
E. Somers  
D. Bates  
C. Burnham  
J. Burnham  
M. Sheill  
M. Athie  
A. Banksland  
M. Ivanitz