



Is environmental health really a part of economic development - or only an afterthought?

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SUMMARY: *This paper highlights the lack of consideration given to health and the absence of health professionals in decision-making processes in most development projects. This is illustrated by an analysis of World Bank infrastructure projects. Yet, as the paper explains, improved infrastructure may be able to relieve up to 44 per cent of the disease burden in low and middle-income countries and do so at a fraction of the cost of investments in health care. Thus, it might be possible to extract as many (or more) health improvements for a lower cost through investments outside the health sector. The paper also gives examples of the economic benefits that arise from the inclusion of health factors in policy and these can help justify investments that could otherwise be considered too costly.*

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I. INTRODUCTION

THE NOTION THAT environmental health considerations are largely absent from policy-making throughout business, commerce, industry and government is based on a simple premise drawn mainly from observations in low and middle-income countries but certainly applicable to high-income countries as well, namely that most causes of disease, injury and death - that is, inadequate infrastructure (especially, sanitation, water, waste removal and housing), poor personal hygiene, traffic injuries, tobacco smoking - lie outside the purview of the health sector. Yet, policies of the sectors that exert these negative health impacts are *not* set with health criteria in mind, with the occasional exception of pollution emission standards. By comparison, health sector policy *per se* tends to focus on interventions by the health care delivery system, not on the sectors that are the source of the problems.

This premise was confirmed by a range of analyses conducted at the World Bank, of which two are especially significant. Whereas these analyses differ in focus, they each reinforce the notion that environmental health policies could be far more effective. The first study, *The Impact of Development Policies on Health*,⁽¹⁾ was a literature analysis covering nearly 400 publica-

1. Cooper Weil, D.E. et al. (1990), *The Impact of Development Policies on Health - A Review of the Literature*, World Health Organization, Geneva.

2. Listorti, James A, (1996), *Bridging Environmental Health Gaps*, AFTES Working Papers Nos.20-22, Urban Environmental Management, Africa Technical Department, the World Bank, May.

3. World Bank (1993), *World Development Report 1993: Investing in Health*, Oxford University Press for the World Bank, Table 2, page 10.

4. World Bank (1997), "World Bank offers "green top ten" in advance of UN earth summit", World Bank Group News Release No.97/1377S, Washington DC, June 5.

tions on general macro-economic planning, agriculture, industry, energy and housing. Two overriding conclusions stand out:

- health repercussions have generally not played an important role in policy decisions outside the health sector - except where a high level of understanding about health linkages already exists, e.g., water pollution and road injuries; and
- macro policy decisions appeared to be based more on technical factors within a sector than on their application in a broader context, e.g., on occupational exposures and the immediate use of chemicals rather than on their long-term accumulation in watersheds.

The second study, *Bridging Environmental Health Gaps*,⁽²⁾ consisted of an examination of some 200 infrastructure sector projects in sub-Saharan Africa and a wide literature review of over 2,000 books and articles and about 300 published World Bank documents. The analysis of Bank infrastructure sector projects concluded that:

- the contributions of infrastructure projects toward poverty alleviation and improvements in living conditions could be significantly enhanced by systematic consideration of opportunities for health improvement; and
- for a fraction of the cost of health investments, infrastructure *may be able* to relieve up to 44 per cent of the burden of disease, as opposed to the 32 per cent estimated for the health sector.⁽³⁾

The "table of consequences" below gives samples of cases where health was not factored into policy and practice. (Since the table is speculative, it is not numbered.) The information it contains includes some surprises. For example, in 1997 the World Bank expressed its concern over the lack of momentum after the Rio Summit. So the Bank tried to "jump start" some of the agreements arrived at at the Summit that many environmentalists felt were making insufficient progress. The Bank thus identified the "Green Top Ten" initiatives:⁽⁴⁾

- Phase out lead in gasoline within five years
- Move towards more aggressive elimination of CFCs
- Build global carbon markets to reduce climate change
- Make water an economic asset
- Make cities more liveable
- Conserve and manage critical ecosystems on land and at sea
- Commit new money to the global environment facility
- Build alliances to transform the market place
- Adopt greener accounting and eliminate harmful subsidies
- Apply environmental and social assessment consistently

The first among these was phasing out lead from gasoline, justified in large measure by potential health benefits. These benefits were based on the success stories of lead reduction, especially the elimination of lead from paint and gasoline, and the considerable health improvements that followed in the USA

and other high-income countries. However, the decision to make this part of the top ten did not include any health staff.

The samples noted in the table below are not so much a veiled criticism as an affirmation of the status quo. In many instances, the absence of any health input merely signifies that projects are achieving less than their potential in an otherwise well-

Table of Consequences

Event/document	Sample health issues	Responsible agencies	Agencies not consulted	Possible health consequences
<i>Health excluded by other sectors</i>				
203 World Bank infrastructure projects	Contaminated water, indoor air pollution, vector related diseases, injuries	Infrastructure: water, sanitation, housing, transport, waste management, urban management, telecommunications	Health	Diarrhoeal diseases, respiratory diseases, vector related diseases; injuries, etc.
World Bank "Green Top Ten" - No.1: Phase out lead in gasoline in five years	Lead pollution; false sense of security in dealing with <i>part</i> of lead problem; no health input into funding lead substitutes	Environment, urban development, transport	Health	Lead "replacements" can cause equal/worse health damage; focus on gasoline can overshadow other more serious lead problems
Kyoto climate change conference	Several indirect effects, e.g., respiratory and vector related diseases	National governments, environment, private sector	Health not part of official agenda	Fuel price changes: a) use of cheaper fuels could have negative effects on respiratory disease; b) economic analysis of dams could expand dam construction with negative effects on schistosomiasis (and malaria ??)
Insurance industry hurricane analyses	Injury and deaths from storms; physical and mental stress from loss of home/job, etc.	Private sector, national and local governments, infrastructure (water, housing, transport, telecommunications), emergency services	Health	Insurance industry calculates property damage but not health, wide range, e.g., sickness to suicide
<i>Other sectors excluded by health</i>				
WHO malaria rollback initiative	Help confront drug resistance, changes in breeding patterns and spread of habitat	Health	Infrastructure (transport, housing, water, waste management), agriculture	Miss opportunity to diminish malaria even more
PAHO disaster preparedness conference	Emergency health services for disaster victims are impaired; diseases, injuries linked to flooding and fire	Health, disaster		Poor maintenance makes public infrastructure more vulnerable to severe weather

intentioned project. This could be the case with most of the World Bank projects described later. However, in many instances, the absence of any health input can lead to disastrous results, the sort that are often described as “unforeseen consequences”. Often they are unforeseen simply because nobody looked.

These two studies and the trial table support the notion that environmental health has been absent from policy-making in a broad range of sectors where it could have made a positive impact. In addition, considerations of environmental health can enhance the overall impact of projects and programmes in various sectors, in particular by improving the economic analysis used to justify investments. The rest of this paper, in seeking to ensure that environmental health is integrated into policy-making, is divided into two parts. The first shows the lack of health considerations in infrastructure projects, even in projects fundamentally aimed at alleviating poverty. The second gives three examples of the economic benefits that arise from the inclusion of health factors in policy and can help justify investments that could otherwise be considered too costly.

II. HEALTH INPUT INTO INFRASTRUCTURE PROJECTS

a. Background on Infrastructure Health Linkages

THIS SECTION LOOKS at World Bank infrastructure sector projects in sub-Saharan Africa for the period 1984-1994. Infrastructure projects (water supply, sanitation, solid waste removal, drainage, housing, urban development, transportation and telecommunications) all have important health repercussions.

Before discussing these, Tables 1-3 are presented to give some basic background on the interrelationships between environmental health and infrastructure in low and middle-income countries. A World Health Organization (WHO) overview of the health situation for “developed” and “developing” countries is shown in Table 1. Since death rates do not capture the full socio-economic impact of disease and injury, these are shown as Disability Adjusted Life Years (DALY), a recently derived measure that combines premature deaths and years lived with disability (YLD). The main characteristics of the “developing” countries which distinguish them from the developed countries revolve around the dominance of infectious and parasitic diseases and the higher share of disability relative to death. These are important distinctions which are not met in the frequent mis-match between research and policy-setting, two factors which actually reflect availability of funding, combined with social and political pressures, of the high-income countries - in essence, research and policy more attuned to cancer than malnutrition. In addition, albeit inadvertently, research and policy for truly global concerns that range from respiratory diseases to climate change are based on conditions in high-income countries and are inappropriately applied to the low and middle-income countries.

Table 1: Top Ten Diseases/Conditions by Indicative Disability Adjusted Life Years (DALY)

Cause	World		Developed		Developing	
	DALY ('000s)	Deaths ('000s)	DALY ('000s)	Rank	DALY ('000s)	Rank
1. Infectious and parasitic	372,539	9,454	5,757	7	366,782	1
2. Cardiovascular	147,920	14,345	39,118	1	108,802	3
3. Respiratory infections	122,790	4,314	3,902	11	118,888	2
4. Unintentional injuries	112,562	2,794	14,244	4	93,318	5
5. Perinatal causes	99,658	2,491	3,432	12	96,226	4
6. Neuro-psychiatric	92,768	832	20,311	3	72,458	6
7. Malignant cancers	80,015	6,129	26,684	2	53,330	7
8. Nutritional/endocrine	53,183	651	2,185	15	50,999	8
9. Intentional injuries	50,100	1,432	6,488	5	43,612	9
10. Chronic respiratory	47,406	2,845	5,708	8	41,698	10
Total of top ten	1,178,941	45,287	127,829	-	1,046,113	-
Top ten and all other causes	DALY 1,361,803	Deaths 49,971	DALY 151,698	Deaths 10,883	DALY 1,210,105	Deaths 39,088
Proportion DALY/death	27		14		31	

SOURCE: Murray, C.J.L. and A.D. Lopez (editors) (1994), *Global Comparative Assessments in the Health Sector*, World Health Organization, Geneva, pages 33-36 and 53-54, Annex Tables 1, 2, and 3.

Sub-Saharan Africa, used as the sample for the analysis of low-income countries, exhibits the characteristics as shown in Table 1. Instead of ranking by DALY, Table 2 shows the relative burden of disease for men and women. Since the top five categories assumed close to 10 per cent each, they made a handy distribution for an analytical framework.

Table 2: Rank and Share of Burden of Disease in Sub-Saharan Africa (1990)

Female		Male	
Rank	Share (%)	Rank	Share (%)
1. Malaria	11	1. Injuries	13
2. Respiratory infections	11	2. Respiratory infections	11
3. Diarrhoeal diseases	10	3. Malaria	11
4. Childhood cluster	9	4. Diarrhoeal diseases	10
5. HIV/AIDS and other STDs	9	5. Childhood cluster	10
Top five sub-total	50	Top five sub-total	55

Childhood cluster consists of peri-natal conditions: whooping cough, poliomyelitis, diphtheria, measles and tetanus.

SOURCE: The World Bank (1994), *Better Health in Africa: Experiences and Lessons Learned*, Washington, DC, Tables 2-4.

Table 3: Sample Health Linkages with Infrastructure Interventions

Disease/condition	Type of infrastructure remedial measure
Respiratory disease	Improved housing; air pollution abatement, e.g., in household ventilation and traffic management
Diarrhoeal diseases and intestinal worms	Improved drinking water supply and waste management
Unintentional injuries	Reduction of household and traffic injuries
Vector related diseases	Improved vector control; sanitation and drainage
AIDS	Education of truck drivers

By definition, infectious and parasitic diseases are inextricably linked with infrastructure sector projects by the very nature of the preventive remedial measures that such projects can promote. A sample of such health linkages for sub-Saharan Africa is given in Table 3. The last category, AIDS, is especially important to understanding the overall goal that we are striving for: a more systematic inclusion of health in environmental reviews as an approach to tapping health benefits outside the health care system, with an initial focus on the infrastructure sector (to be followed by other sectors). In the African context, truck drivers have, literally, been a major vehicle for AIDS transmission, in particular through prostitutes at the myriad of truck stops. Thus, to reach out to that audience, preventive measures could be better implemented in conjunction with a transport agency rather than exclusively through a health agency.

b. Environmental Health Dimensions of Sub-Saharan Africa World Bank Infrastructure Projects

Documentation from the preparation of 203 infrastructure project staff appraisal reports (the main document describing a project) was reviewed and revealed three telling observations:

- projects were designed and supervised mainly by engineers and economists;
- environmental health regularly received passing reference but seldom detailed scrutiny;
- health has been most integrated into water and sanitation projects and, to a lesser extent, into transportation projects via traffic safety.

Table 4 shows how little health was mentioned in documentation on these 203 projects - including the staff appraisal reports and the environmental assessments. Forty-two projects mentioned health in the project description, and 38 mentioned it in the economic analysis as a project benefit, but only one project contained an actual health component.⁽⁵⁾ None contained any detailed economic analysis of the health dimensions. Many projects also routinely state that there are no health impacts, without specifying the nature of the analysis that led to that conclusion.

World Bank projects are sub-divided into "components". The varied components making up the 203 infrastructure projects are listed in Table 5. This breakdown can be useful to see where potential environmental health interventions could be pertinent.

c. Health Input into SSA Bank Infrastructure Projects

Of the 203 staff appraisal reports, two projects listed a health specialist as part of the preparatory team,⁽⁶⁾ as shown in Table 6. Of the 203 projects, 62 were completed within the 1984-94 period, which allowed a detailed analysis of the supervisory missions to the field in the project completion reports. Procedurally, each completed project would have had about 10

5. Sudan: Flood Reconstruction.

6. Ghana: Accra District Rehabilitation; also Zimbabwe: Emergency Drought Recovery.

Table 4: Number of World Bank Infrastructure Projects for Sub-Saharan Africa Projects Mentioning Health

Project type	Number of projects	Number of mentions in SAR text	Number of mentions in environmental assessments	Number of mentions in economic analysis	Number with calculations
Transport	89	-	6	-	-
Housing and urban development	47	11	7	18	-
Water and sanitation	35	10	8	17	-
Multi-sectoral	16	3	4	3	-
Telecommunications	16	-	6	-	-
TOTALS	203	24	31	38	0

Table 5: Sub-Saharan Africa Infrastructure Component Distribution, 1984-1994

Housing and urban development		Telecommunications		Transportation		Water and sanitation	
Component type	#	Component type	#	Component type	#	Component type	#
Urban general	24	Telecommunications	18	Railways	19	Water supply	50
Housing	24			Ports	24	Sanitation	27
Drainage	23			Airport	6	Waste management	20
Sites and services	10			River	4	Drainage	13
Public markets	8			Road construction	14		
Urban transport	4			Road rehabilitation/maintenance	177		
Public buildings	2	Institution-building	16	Institution-building	129	Institution-building	39
Motor parks	1						
Institution-building	90						

Table 6: Number of Specialists in Project Preparation

Project type	Number of projects	Number completed	Number of health specialists	Number of water specialists	Number of engineers	Number of sociologists	Not specified
Transport	89	30	-	-	-	-	-
Housing and urban development	47	10	1	2	1	1	9
Water and sanitation	35	18	1	-	-	1	4
Multi-sectoral	16	-	-	-	-	-	4
Telecommunications	16	4	-	-	-	-	-
TOTALS	203	62	2	2	1	2	17

7. Ghana: Accra District Rehabilitation.

supervision missions to the field, or roughly 620 missions for the 62 completed projects. Of the 62 project completion reports, one project⁽⁷⁾ listed a health specialist as having gone on two of the approximately 620 missions.

The breakdown of staff contributing to the preparation of the staff appraisal reports showed that the majority of staff were economists, financial analysts, engineers (transport, communications, water, sanitary and municipal) and, in the housing and urban development sector, urban planners. Those specialists with competence to deal with environmental health issues and for which the specialty was specified are listed in Table 6. This would include core team members and consultants added to the team. It is important to stress that a team without a health specialist does not necessarily constitute a defect in project preparation and supervision but it does leave the door open to ask whether a health specialist could have improved the project's performance and social benefits.

For the health input into environmental assessments, the analysis was inconclusive for the 124 (of the 203) projects which were subjected to environmental reviews, some of which included formal environmental assessments (EAs). None went into any depth on cross-sectoral environmental health linkages. Since environmental assessment procedures do not require environmental health analyses, it was not possible to distinguish whether routine analysis included issues beyond water pollution.

Would the active participation of health specialists have changed the component composition of any of these projects or, more importantly, their long-term results? The degree to which health specialists would have changed the health outcome of infrastructure projects remains uncertain. For example, many water and sanitation projects routinely contain components such as hygiene education or sanitary inspection of facilities. In many clear-cut cases such as these, adding a health input could increase project cost without necessarily producing additional benefits over those already covered by engineers. *However important it may be to draw attention to the lack of health input, it is just as important to note that not all components necessarily need a separate environmental health review, especially in cases where health linkages are clear and typically included as part of "best professional practices" or, as is often the case, when the components address the very same issues as health, but from a different discipline such as engineering.*

Nonetheless, active participation by health professionals has been minimal and their contribution to cases that are not clear-cut has not been evaluated. The question is whether the health analysis is sufficiently broad so as to include factors beyond pollution, which is the most frequent concern.

- Ground water pollution of solid waste management, for example, would be "automatic", but not necessarily vector control, which could fall through the analytical cracks if the consulting engineers came from a country where mosquitoes were a "nuisance" rather than a health hazard.
- Poor drainage is another factor generally considered a nui-

8. The mosquito species that spread malaria and dengue have different breeding and feeding habits; see the paper by Peter Kolsky in this issue.

sance or a safety hazard in high-income countries but one that can lead to a range of vector borne diseases. Malaria or dengue can be spread when drinking water is not properly evacuated around residences.⁽⁸⁾ In rainy periods, leptospirosis, the most widespread animal-to-human disease (spread by mammal urine, often rats), can readily become a public health problem in poor areas when poor drainage and heavy rains cause flooding, carrying with it animal excreta.

Ground water pollution and poor drainage are but two examples that underscore the need for environmental health reviews to help compensate for the lack of exposure of engineers and economists who have received their technical training in high-income countries where similar problems were reduced to insignificant levels 50-100 years ago. Today, if mosquitoes are considered at all, it is as a nuisance and not as a health threat for malaria or dengue.

III. ECONOMIC BENEFITS

SOLUTIONS TO THIS wide range of potential problems highlighted in the infrastructure projects *are* possible. But they need to be included on agendas as preventive measures in the very same business, commerce, industry and government agencies that are responsible for creating the problems - but where they have not yet been accepted as an important consideration. **Environmental literature shows that health is typically not included as a benefit except for pollution control.** If other factors are included, it could change the justification for environmental investments. Considerations of environmental health can enhance the overall impact of projects dealing with natural resource management and ecology, in particular by improving the economic analysis used to justify investments. Many "green" projects are portrayed as too costly, especially by the private sector which extends the argument to include the negative effects this can have on stifling economic growth. Introducing potential health benefits can help offset such arguments. However, collectively, the three disciplines of health, environment and economics have not reinforced each other's efforts, which has been detrimental to promulgating the cause of environmental health and may be one of the reasons why health has been absent from policy.

- Health, too often, is considered a separate issue rather than an integral facet of ecology. By and large the green community has done a much better job than the health community in promulgating its ideas into policy.
- Economic analyses have concentrated more on costs than on benefits; while health analyses have concentrated more on solutions of the health care system itself than on preventative measures outside.
- Environmental analyses have concentrated on localized pollution while neglecting other equally important factors.

Three recent studies show how economics can be an important force in overcoming some of the obstacles that have kept environmental health from being a policy determinant.

- A US Environment Protection Agency study gives sound evidence of the socio-economic benefits of investing in the environment based on health improvements, in this case, the costs and benefits of the Clean Air Act over 20 years. *US\$ 436 billion in costs produced US\$ 6.8 trillion in human health benefits, or a rate of return of US\$ 15.60 for every dollar spent.* From 1970-1990, carbon monoxide emissions (which come mainly from vehicle exhausts) were reduced by 50 per cent, sulfur dioxide emissions (mainly from combustion of fuels for heating) by 40 per cent, and airborne lead (mainly from automobiles and lead smelters) by 99 per cent.⁽⁹⁾
- Another study, prepared for release at the Kyoto Summit, details the considerable savings in human life possible over the short term by reducing carbon emissions. That study predicts that by 2020, there could be 700,000 avoidable annual deaths as a result of additional particulate matter exposure under the "business as usual forecasts", compared to the "climate-policy scenario" where high-income countries undertake significant reductions. The cumulative total from 2000-2020 globally could be about 8,000,000 averted deaths.⁽¹⁰⁾
- Finally, recall the World Bank study cited earlier that suggests that it might be possible to have a greater health impact from investments in infrastructure than in the health care system. A potential 44 per cent of the burden of disease is amenable to improvements in infrastructure, compared with an estimated 32 per cent for the health sector.⁽¹¹⁾ (Additional work on this topic, under the Bridging Environmental Health Gaps programme at the World Bank, aims to subject the 44 per cent to rigorous economic analysis to bring the notional "guesstimate" into a reasonable estimate.)

The World Bank study also identifies a similar concept that has not been fully explored, that of *comparative environmental health benefits from different sectors*. That is, if we look systematically at health benefits outside the health sector, we could expect different results from different sectors. Bearing in mind that respiratory and diarrhoeal diseases are still two of the top health problems throughout Africa, Asia and much of Latin America, what if infrastructure investments are shown to produce more return per unit of investment than health care by reducing diarrhoeal and respiratory diseases as well as traffic injuries? What if the same can be said of energy sector investments and their role in reducing respiratory disease?

This notion provides considerable food for thought, especially for economists since their input - that of defining and quantifying costs and benefits - is key to decision makers who set policy and control budgets. All the more so if those decision makers do not have a health background, which is probably the case, since their policy decisions are heavily biased toward cost considerations. For instance, in the above example contrasting the 44 per

9. US EPA (1996), *The Benefits and Costs of the Clean Air Act, 1970-1990*, draft, May 3, pages 130-132 and page vii.

10. Working Group on Public Health and Fossil-Fuel (1997) "Short-term improvements in public health from global-climate policies on fossil fuel combustion: an interim report", *The Lancet* Vol.350, November 8, pages 1341-49.

11. See reference 2, Vol.I, page 10.

cent "guesstimate" from infrastructure against the 32 per cent actual estimate from health, we need to consider the justification of the *initial investment*. Health sector investments are justified largely on the basis of health improvements coming through the health care system but infrastructure investments are justified largely on other grounds which only partially include health improvements, if at all. Thus, if an infrastructure project were to add a health component, its cost would be only a small part of the overall project cost, say 2 per cent. Thus, as a hypothetical thumbnail calculation, take two investments of US\$ 1 million each. For the health project, 100 per cent of the investment, theoretically, could target a maximum potential reduction of 32 per cent of the burden of disease; whereas, in the infrastructure project, just 2 per cent of the investment could target up to 44 per cent! No matter how we adjust the figures for their relative impacts on different populations at risk or for cost-effectiveness of different interventions, the point remains that it *might* be possible to extract as much (or more) health improvement for a lower cost through investments outside the health sector. The notion of systematically tapping health benefits outside the health sector to enhance health investments needs further exploration.

An example can help put this in perspective, based on data from the World Bank's *1993 World Development Report: Investing in Health*. As measured in DALYs, it appears possible to obtain more return per unit investment ("bang for your buck") in reducing the burden of disease depending on which sector you invest in. For example, compare the reduction of the burden of disease from interventions in two complementary sectors, namely, respiratory disease reduction in the energy sector and traffic injury reduction in the infrastructure sector. It appears that the same investment, if spent in the energy sector, might reduce by eight times the burden of respiratory disease than if it were spent in the transport sector to reduce traffic injuries. Reducing respiratory disease would have to concentrate on indoor air pollution and focus interventions largely in two areas, that is, the household (mainly through better ventilation and improved stoves) and, to a lesser extent, ambient air pollution abatement (mainly from traffic and industry). This would be equivalent to 1,800,000 DALYs and could be achieved at a cost of US\$ 85.6 million based on thumbnail calculations from selected World Bank energy sector projects. By comparison, reducing traffic injuries would require multi-pronged road safety interventions including legislation, financial incentives, programmes of road safety, education, insurance and liability systems. This would be equivalent to 460,000 DALYs and would cost US\$ 172 million based on calculations from selected World Bank transport sector projects.⁽¹²⁾ No one is suggesting that we forgo transport investments for stoves to reduce the burden of disease but the comparative figures do suggest that one looks more closely at environmental benefits in order to enhance health sector benefits.

These three studies and the above example show that environmental health has an enormous economic value that has

12. See reference 2, Vol.I, Annex A, pages 3-4, adapted from *Investing in Health* (see reference 3), Tables 4-6, page 95, Table B-6, page 223 and B-7, page 224.

been excluded from many policy discussions. In addition, the private sector, a major force arguing against environmental and health considerations, tends to argue about disincentives of added costs. The Environment Protection Agency example is extremely useful in this regard as a potential rebuttal. Initially, environmentalists estimated that sulphur dioxide reduction would cost US\$ 300/tonne and industry's estimate was US\$ 1,500/tonne, whereas actual costs today are about US\$ 65/tonne. Moreover, it was also thought that other important air pollutants, namely, carbon monoxide, particulate matter and chlorofluorocarbons (CFCs) would be more costly to control; they too have been reduced, the latter by 90 per cent.

However one might quibble over the accuracy of the costs and benefits themselves or the methodology for estimating them, it remains clear that potential benefits are sizeable and, at an absolute minimum, can pay for themselves! The most important point, however, is to raise awareness based on professional judgement. The spate of technical deficiencies can eventually be sorted out.

IV. RECOMMENDATIONS

THIS BRIEF REVIEW could only touch on one area of environmental health problems, those related to infrastructure interventions. It did not address many equally important issues from other sectors such as energy or agriculture. In the meantime, while awaiting precise recommendations from future work on *Bridging Environmental Health Gaps*, some general recommendations include the following:

- **For researchers and practitioners:** Translate research findings into plain language and show their utility to society. Instead of "The Neurotoxic Effects of Organochlorines," use something like "Damage to the Nervous System from Widely Used Pesticides that Accumulate in Body Fat." If professional journals discourage interpretation of findings, then prepare a separate discussion piece for submission at the same time, as a "letter to the editor."
- **For academics:** Wherever possible, promote combined degree programmes to expose future leaders to the range of issues; encourage a minimal exposure of science students to sociology and economics and vice versa.
- **For international aid agencies and national environmental agencies:** Establish procedures to include environmental health within the environmental assessment process. "Rapid Environmental Health Assessment Checklists" and "Multisectoral Environmental Health Guidelines" are currently being prepared at the World Bank with support from Norwegian, Swedish, Swiss and other governments.