



World Ecology Report

Critical Issues in Health and the Environment

Knowledge brings new choices. Education brings new knowledge.

Health and Environment: Global Partners for Global Solutions



PART I

This issue of the *World Ecology Report* represents first of a two part series that contains the abstracts of the papers presented at our recent *Health and Environment: Global Partners for Global Solutions* Conferences. Since 1992, World Information Transfer has held annual conferences at the United Nations Headquarters in New York City on the environmental impacts to human health. The conferences have been co-sponsored by the governments of: Ukraine, Egypt, Malaysia, Brazil, and Lebanon, respectively. The information covered at WIT's conferences is often not presented in the *World Ecology Report* and therefore, the editors decided to reprint the conference abstracts so that individuals who may not have had the opportunity to attend WIT's conferences will have the benefit of the information. The issues are organized by topic rather than conference theme. The papers in this issue discuss direct environmental assaults and their relationship to human health. Further information on the papers published in these two special issues is available from World Information Transfer headquarters.



L to R: **Dr. Steven Esrey; Mr. Farouk Mawlawi; Minister of Health of Lebanon, Excellency H.E. Marwan Hamadeh; Dr. Christine Durbak; Dr. Bernard D. Goldstein.** United Nations N.Y. April 25, 1996

The Environment as a Cause of Human Disease

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The relationship between human health and the environment is a complex one. While disregard for the environment can adversely effect human health, societies rife with poverty and diseases have little incentive to deal with long-term environmental issues; they have to focus on day-to-day survival. However,

example after example shows us that failure to protect the environment imperils human health, both today and tomorrow.

Although the effects of air pollution on our health are now well recognized, it is not always clear to what extent an environmental pollutant is responsible for disease. In some cases, it may act as a catalyst, activating genetic factors that by themselves do not cause disease. Environmental insults may also indirectly endanger human health; for example, deforestation can create an area of erosion that allows devastating flooding, as in the

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Populations Affected by Various Infectious Diseases, 1993

Disease	Deaths	Incidence ¹
Acute Respiratory Infections	4.1 million	248 million
Diarrheal Diseases	3.0 million	1.8 billion
Tuberculosis	2.7 million	8.8 million
Malaria	2.0 million	300-500 million (prevalence ²)
Measles	1.2 million	45 million
Hepatitis B	1.0 million	2.2 million
HIV/AIDS	700,000	2-3 million
Whooping Cough (pertussis)	360,000	4.3 million
Bacterial Meningitis	210,000	1.2 million (prevalence ²)
Schistosomiasis	200,000	200 million (prevalence ²)
Leishmaniasis	197,000	7.2 million
Yellow Fever	30,000	200,000
Dengue/DHF	23,000	560,000
Japanese Encephalitis	11,000	40,000
Cholera	6,800	380,000
Polio	5,500	110,000

¹Number of new cases of a particular disease reported during a certain period of time.

²Number of cases of a particular disease reported during a certain period of time.

SOURCES: Report of the Director-General, *The World Health Report 1995: Bridging the Gaps* (Geneva: World Health Organization, 1995); malaria data from "World Malaria Situation in 1992, Part I: Middle South Asia, Eastern Asia and Oceania," *Weekly Epidemiological Record*, October 21, 1994; HIV/AIDS incidence data from Aaron Sachs, "HIV/AIDS Cases Rising Steadily," in Lester R. Brown, Hal Kane, and David Malin Roodman, *Vital Signs 1994* (New York: W.W. Norton & Company, 1994).

Bay of Bengal in 1991. Efforts toward sustainable economic development that fail to consider the complex, essential relationship between human health and the environment are doomed to failure.

Global Climate Changes and Infectious Diseases

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Available evidence and the majority opinion of atmospheric scientists suggest that greenhouse gas accumulation will cause (perhaps already is causing)

the biosphere to get warmer. Global climate models diverge in their forecasts of the extent of warming, the regional variation, and accompanying changes in precipitation. The majority opinion is that temperate zones will get warmer (perhaps 1-4° C) over the next 50-100 years, and that some at least will get wetter.

A rise in ambient temperature enhances the activity and reproductive capacity of many insect vectors of disease, and in some cases, also of the pathogenic organisms that are carried by these vectors. The wider distribution and abundance of both vectors and pathogens increases the range and severity of certain epidemic and endemic infectious diseases.

A related change in stratospheric ozone layer attenuation leading to increased surface level ultraviolet radiation is also predicted. The conse-

quences of this include impaired immune responses both of humans and domesticated animals, enhancing their vulnerability to infectious diseases. The outcome of these phenomena is a considerable increase in the risks both to humans and to animal herds of severe epidemics of infectious disease.

Other aspects of global change have to be taken into account. Climate change will likely be accompanied by declining soil moisture levels in the world's principal grain-growing areas leading to reduced agricultural output. Food shortages are already serious in several regions of the developing world: chronic under-nutrition aggravates the impact of infection, so there can be high fatality rates from otherwise trivial outbreaks of infectious disease.

Rich industrial nations have not experienced food shortages because they can afford to buy from food-producing countries, but if climate change seriously impairs agricultural output, this might change; and food shortages in the rich nations would have the same consequences as in the poorer nations of the developing world, including enhanced susceptibility to infections.

Underlying all the human-induced global changes is the relentless demographic force of population growth, currently at an annual rate of about 90 million. This is accompanied by unprecedented population movements, notably rural-to-urban shifts, especially into periurban slums in many parts of the developing world, and also movement from poor to rich nations of large numbers often described as "environmental" refugees. This set of factors also increases the risk of epidemics, people on the move take their diseases with them, and are often exposed to new diseases when they reach their destinations.

Health in Developing Nations

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The close relationship between health and environmental conditions is drawn into focus by the critical socioeconomic changes that are affecting the developing countries. Because of the shortcomings in the fulfillment of basic sanitary needs, in many nations diarrheal and parasitic diseases are a leading cause of high mortality and morbidity among certain population groups, especially children and the aged. At the same time industrialization and urban growth have increased the health risk from exposure to toxic substances and hazardous wastes that are polluting the air, water, soil, and food.

The adverse effects of industrial activities on human health cover the spectrum from relatively high-level exposures of small populations in the occupational setting to usually lower level of exposure of the general public. While there are a few clear-cut cases, such as acute intoxications associated with exposure to pesticides, illness caused by long-term exposure to pollutants is often difficult to identify conclusively.

Diarrheal Diseases and Cholera Outbreaks

Diarrheal diseases constitute one of the most important health problems, affecting children in particular. The magnitude of the problem differs markedly from developing to developed countries. Among children under 1 year of age, mortality rates for diarrheal disease range from 0.5 per 100,000 live births in Canada to 967.3 per 100,000 live births in Nicaragua, a figure almost 2,000 times higher.

The mortality rate for diarrheal diseases other than cholera is declining in all developing countries, basically due to wide use of oral rehydration therapy.

Cholera is almost always introduced into new areas by infected travelers. However, within infected areas, disease is transmitted from person to person by contaminated food and water. An outbreak of cholera in Kinshasa, Zaire, which began this past February, has killed 27 people as of March 25 (Reuters). The epidemic has not spread to beyond the capital city as had been reported according to WHO's representative in Zaire, but there were indications that the outbreak was not confined to poor areas. Illness, like pollution, knows no economic or national boundaries. The Joint Food and Agriculture Organization/World Health Organization (FAO/WHO) Expert Committee on Food Safety has stated that food-borne illnesses constitute the most widespread group of diseases in the world. According to published data, more than a billion cases of diarrheal diseases occurred in children under 5 years old, meaning that contaminated water and food were responsible for the high infant mortality recorded in the developing countries.

Disposal of untreated waste water constitutes a critical problem in all developing countries. The waste contaminates and damages water courses and groundwater, which are the sources of drinking water for large and small communities. In addition, this water is often used for bathing, recreation, irrigation, raising fish, thus further increasing the potential for health problems.

The large-scale use of untreated domestic sewage for irrigation is common in many arid and semiarid zones. High rates of enteritis, typhoid fever, and hepatitis occur as a result of the consumption of raw vegetables irri-

gated with untreated waste water.

Chemical Emergencies

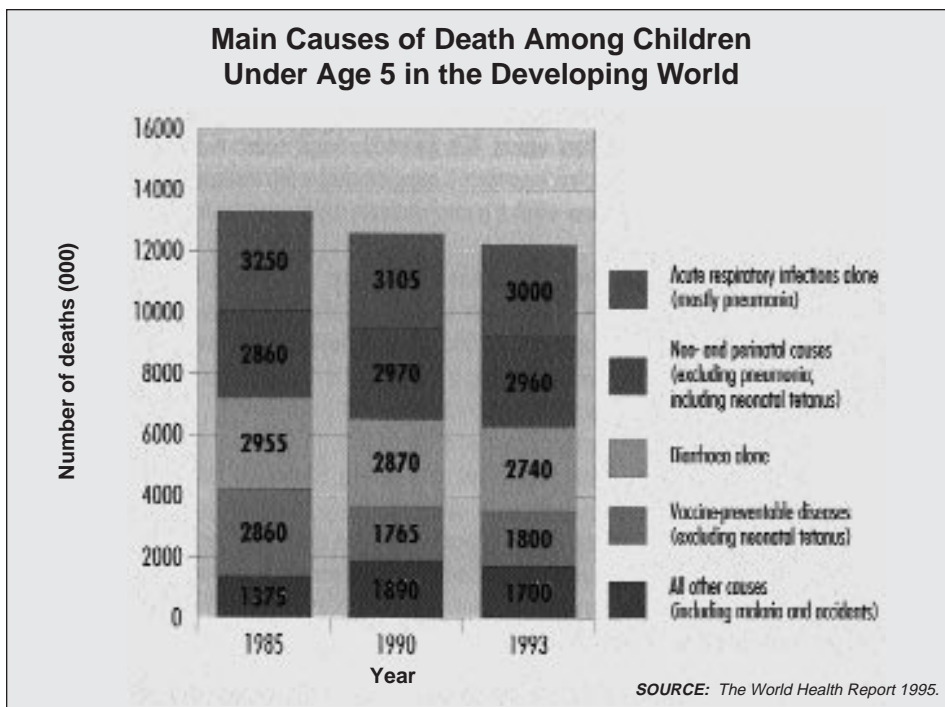
As industrial activity in both developed and developing countries has increased, the potential for major catastrophes has also increased, and the number of significant accidents involving chemicals with serious health and environmental effects has been rising. Furthermore, particularly with the massive expansion in the availability and use of chemicals in developing countries, the number of poisonings of all types has increased, from household emergencies (children swallowing chemicals at home) to industrial devastation (production or storage plant explosions and product releases).

The most common chemical accidents in almost all countries involve flammable liquids and gases.

The large accidents, such as the massive release of industrial chemicals in Bhopal, India, in 1984 are usually the ones that attract the public's attention, but the most common accidents are the smaller ones that occur during the routine handling and transportation of chemicals.

Arsenic Exposure

Arsenic is a naturally occurring element that is widely distributed in the environment. All human beings are exposed to low levels of this element. Arsenic has been classified by the U.S. Environmental Protection Agency as a known human carcinogen when exposure occurs by inhalation and oral routes. In developing countries above-average levels of exposure are associated with ingestion of drinking water naturally contaminated with arsenic or by inhalation and ingestion of contaminated soil around copper smelters. Although treatment facilities have been introduced to reduce arsenic content in the drinking water supplied to the larger cities, many people continue to be exposed to unsafe levels of arsenic



in their water.

Chronic exposure to arsenic in drinking water has been reported in Argentina. The estimated population at risk exceeds 1 million inhabitants, some of them living in small towns and villages scattered in large, semiarid territories. In Argentina chronic arsenic poisoning is a widespread public health problem, known since 1913. Cutaneous alterations (keratosis in palms and soles, melanoderma, and multiple epitheliomas) have been described.

Air Pollution

Over the past years, air pollution, resulting from urban development and rapid industrialization, has become a major issue.

Adverse health effects have been associated with three types of air pollutants: 1) sulfur dioxide and particulates arising from the combustion of fossil fuels; 2) photochemical oxidants formed in the atmosphere from a complex chemical reaction between precursor hydrocarbon compounds and

nitrogen oxides, which are largely related to such motor-vehicle emissions as carbon monoxide; and 3) a miscellaneous class of air pollutants such as hydrogen sulfide, lead, and cadmium, which are mostly emitted by such localized point sources as smelters, refineries, power plants, and manufacturing plants.

Air pollution has most severely affected the large metropolitan areas with concomitant increases in total suspended particulates (TSP) and sulfur dioxide (SO₂). In many urban areas the mean annual TSP exceed 100 ug/m³: the WHO recommended value is 60 to 90 ug/m³. It is expected, as published in epidemiological studies that these exposures, adjusted for age, will be linked with about 6% of the reported mortality due to respiratory pathology. These pollution levels contribute to the increases of chronic cough among children and chronic bronchitis among the elderly.

Considering that the trend toward urbanization will not decline, and that it is closely linked with a continuous

increase in the number of vehicles on the road and with local industrialization, it is very likely that efforts to control auto and industrial emissions will not be effective enough to reduce air pollution. On the contrary, there is a great chance that air quality in the large metropolitan areas will continue to decrease placing even more people at a higher risk.

Child Health and the Environment

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Environmental toxins to which children around the world are widely exposed include pesticides, air pollutants, inorganic lead, and asbestos.

Numerous episodes of pesticide poisoning in children have been documented throughout the world, with particular severe episodes having occurred in developing nations. Children have often been permanently disabled or have died in these episodes. Pesticides that present a major threat to children are organophosphates, carbamates, and paraquat. The export to the Third World of pesticides that are banned in developed nations contributes to the problem.

Children are also widely exposed to air pollution. Oxides of nitrogen and ozone are the principal air pollutants that arise from the combustion of petrochemicals, while sulfur oxides and airborne particulates arise from the burning wood, coal, and other biomass fuels. Each of these atmospheric contaminants is capable of causing respiratory irritation and asthma in children.

Recent worldwide increases in the incidence and severity of childhood asthma appear to be related, at least in part, to increasing levels of air pollutants in many nations. Sooty particulates containing polycyclic aromatic compounds are carcinogenic.

Children often come into contact with lead. In the United States more than 4 million children have blood lead levels above 10 mg/dl, the level considered by the Center of Disease Control in Atlanta to indicate pediatric lead poisoning. Pediatric blood lead levels greater than 10 mg/dl have been associated with persistent learning difficulties and behavioral problems. In nations around the World, principal sources of lead include the burning of leaded gasoline, industrial emissions, and lead particulates carried home from workplaces on shoes, skin, hair, and clothing of industrial workers.

Asbestos is a proven human carcinogen that has been shown to cause lung cancer, malignant mesothelioma, and gastrointestinal cancers.

Children may be exposed by inhalation to airborne asbestos fibers released from disruption of concrete-asbestos pipe. In the United States it has been estimated that approximately 1,000 of today's children will die prematurely during the next 30 years from mesothelioma and lung cancer caused by exposure to airborne asbestos released from building materials in schools. Although new installation of asbestos is largely banned in the United States, worldwide the use of asbestos is rapidly increasing.

Finally, child labor represents a widespread source of childhood exposure to many environmental toxins. According to the International Labor Organization, at least 200 million children worldwide under the age of 14 are gainfully employed.

Toxic Waste and Childhood Development

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Humans and waste go hand in hand. In the last decades problems of toxic waste have gained prominence in the media. Differences exist between scientists and the general public on the importance of certain toxic wastes, whether or not public or private action is needed, and if so, how to proceed.

This paper develops a conceptual framework for understanding toxic waste and child development using three examples: lead, infectious disease agents and pesticides. A toxic waste is a useless, superfluous or discarded substance that causes illness or death when eaten, drunk or inhaled. Children are also not miniature adults. They have different exposures and susceptibilities to toxic wastes, which make them more vulnerable to the adverse health effects. Once the toxic waste enters the child's environment, it can be transmitted through various channels (e.g., air, water, soil and food) and absorbed through a variety of routes (e.g., placenta, skin, lungs and digestive tract). If healthy children are exposed to toxic wastes at certain levels, they will become diseased. If the disease is severe enough, they will die. Between health and death three points of intervention exist: primary (between health and exposure), secondary (between exposure and disease) and tertiary (between disease and death). Primary interventions are health care, whereas secondary and tertiary interventions are disease care. Usually several, complimentary, primary interventions are required to prevent exposure, thus highlighting the need for complimentary interventions for health and disease care. Primary interventions fall into two types of categories: individual and societal. If individuals have the knowledge, they

usually have the capacity to minimize their exposure by simple actions. Societal interventions require a more concerted effort to prevent the toxic waste from gaining access to the environment or to remove the toxic waste from the environment when present.

Environmental Factors and Women's Health

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Introduction

Although women throughout the world generally live longer than men, they are not necessarily living better. Overall, women suffer poorer health outcomes and greater disability from disease than do men. Many diseases are unique to women or may be more prevalent in women. Heart disease is the number one killer of American women, but women receive less aggressive diagnostic and treatment interventions from heart disease than do men. Most past research studies and clinical trials have assumed there were no differences between men and women and were all conducted on white males. Past inattention to women's health issues in both the conduct of research and clinical practice has resulted in serious gaps in knowledge about the causes, treatment and prevention of diseases in women.

The status of women's health is determined by complex interactions between the environment, individual susceptibility, and time. Of these three elements, only environmental exposures are within our control. The environment is defined in its broadest sense including diet, drugs, heat, noise, lifestyle, and behavioral, social and

Income Ranges with Life Expectancy at Birth and Infant Mortality Rate

Income Range (per capita GNP in US\$) 1992	Life Expectancy at Birth (years) 1993	Infant Mortality Rate 1993
15,000 and above	70-79	5-26
10,000-14,999	72-78	7-22
5,000-9,999	63-77	9-68
1,000-4,999	51-76	10-93
500-999	45-72	24-133
100-499	43-71	27-158

SOURCE: *The World Health Report 1995.*

economic factors. Socioeconomic status, nutrition, etc., may have greater health impacts but exposure to environmental chemicals cannot be ignored. Individual susceptibility is defined as an inherent or pre-existing difference that effects the response of an individual to an environmental exposure. Susceptibility may be due to a number of factors, but is often due to heritable genetic differences in a specific gene. The time exposure is also a critical element, both in terms of chronological age and the time when exposure occurs. This is particularly true for women. Certain exposure during pregnancy can have devastating, permanent consequences on children, and the aged may also be particularly vulnerable.

Environmental exposures known to effect women's health include nonoccupational exposures through chemicals in air, water, food, soils, and dusts. These exposures result from contact with these media, from polluted drinking and contaminated food, and from the use of consumer products containing toxic chemicals. Women now make up a significant portion of the workforce and may also be exposed to a variety of toxic agents in the workplace.

In recent years, a number of industrial chemicals and environmental pol-

lutants in the environment have been shown to have the capacity to act as hormones. These "environmental hormones" can mimic the effects of the natural hormone, or block the effects by binding to hormone receptors, and thus disrupt a wide array of biological processes, frequently affecting the reproductive and endocrine system (1). Much of the research has focused on environmental compounds that can mimic the effects of the female compounds as DDT, banned or severely restricted pesticides such as dieldrin, kepone, and heptachlor. PCBs exhibit these properties as do certain ingredients in plastic, combustion pollutants breakdown products of detergents, product of fungi, mycotoxins, and plant estrogens (2). many of these compounds are transported long distances and deposited via the atmosphere into soil, water, etc.; thus entering the food chain. They are ubiquitous and persistent in the environment. The hormonal activity of these chemicals bears little resemblance to their intended function. Unfortunately, there is no way to predict which ones will exhibit hormonal activity, based on structure alone and chemicals must be tested for these effects (3).

These chemicals vary in their degree and manner but have been shown to disrupt the sexual and reproductive

development of fish and wildlife, often resulting in infertility and effecting the development of both male and females (4). Exposure of these chemicals in utero or in early development, may have permanent effects on the offspring and may have profound implications for future generation. In utero exposure to diethylstilbestrol (DES) used to prevent miscarriages in woman until the 1970s has been linked to adverse effects in both the male and female offspring (5).

Many of these chemicals are only weakly estrogenic, but cumulative exposure to them should be of particular concern to women. We know that exposure to estrogens is associated with a number of diseases/dysfunctions including breast and uterine cancer.

Breast Cancer

The incidence of breast cancer has increased substantially since the 1950s. Concern has been expressed regarding the role of environmental estrogens as possible contributors to this increase in breast cancer (6). Some studies have shown a positive relationship between exposure to polychlorinated biphenyls and DDT, whereas other studies have failed to duplicate these effects. (7). Further research is clearly required to determine the factors associated with the increasing incidence of this disease.

A team of researchers including scientists at the National Institute of Environmental Health Sciences (NIEHS) have recently isolated and cloned a breast cancer susceptibility gene, BRCA1 (8). An inherited susceptibility to breast cancer due to mutations in BRCA1 is thought to account for 25% of early onset breast cancer. The isolation of the BRCA1 gene brings us closer to understanding the origins of breast cancer, which will be vital in developing effective breast cancer treatments.

Endometriosis and Endometrial Cancer

Endometriosis, characterized by endometrial tissue growing outside of the uterus, affects an estimated 10%-15% of the premenopausal female population and is a leading cause of pain and infertility in this population. Despite vast clinical literature on this topic, the etiology of endometriosis remains obscure. Many of the risk factors for this disease are related to estrogen exposure. Thus environmental estrogens may contribute to the development of endometriosis in susceptible individuals. The NIEHS is studying the roles of both environmental estrogens and genetic factors in this disease. Endometrial cancer is the most frequently diagnosed gynecologic malignancy in the United States, yet it remains the least studied of the major cancers affecting women. NIEHS scientists are conducting studies to better understand the role of both natural and environmental estrogens in the development of endometrial cancers (9).

Uterine Fibroids

The most common tumors in women are benign uterine fibroids, or leiomyomas. These tumors are present in 20%-30% of women over age 30; uterine fibroids are more common in African-American women. This condition can cause significant pain and discomfort in the women afflicted with it. There is a considerable body of evidence that supports the role of estrogen in the development of this tumor. Consequently, chronic exposure to environmental estrogens could contribute to a woman's risk of developing this disease, and studies are needed.

Osteoporosis

Osteoporosis is a debilitating condition characterized by fragility of the bone. It is particularly prevalent in postmenopausal women. Cadmium, lead and possibly other heavy metals

found in the environment may be significant factors in developing this disease (10). NIEHS scientists are investigating the mechanisms by which metals in our environment lead to osteoporosis.

Conclusion

A large number of significant diseases of women are largely unexplained and inadequately studied. The contribution of environmental exposures in inducing these diseases/dysfunctions must be examined.

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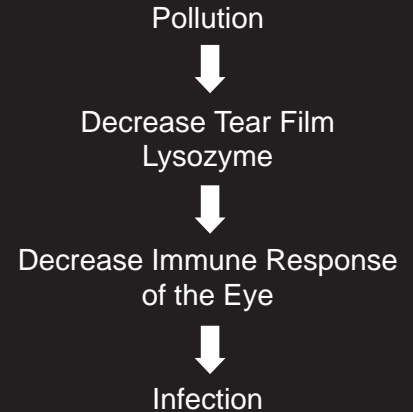
Ocular Effects of Air Pollution

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Air pollution by definition is "the presence of the contaminants in the air which can cause discomfort or pose health risks. Isolating the health effects of air pollution is a complex process, becoming an even greater challenge when dealing with the effects of air pollution on the eyes. Air pollution has been researched extensively, primarily for the pulmonary system. Parallels can be drawn between the effects of air pollution on the mucous membranes of the lungs and the conjunctiva of the eyes. Ocular symptoms usually pre-

TABLE 1
 Ocular Effects of Air Pollution



cedes problems of the respiratory system. The conjunctiva is a thin layer which usually covers the eye ball and the inner surface of the eyelids. Eye irritation is one of the most common effects of air pollution on the human body. Effects of pollution on the elderly and newborns are more severe due to lower immunity. Exposure to pollutants results in a significant reduction in the tear lysozymes, because of this there is a decrease of ocular immune response and increase risk of infection (See Table 1).

The two major categories of outdoor air pollutants are referred to as primary and secondary air pollutants. Primary air pollutants are those emitted from a known source and made up of fine particles less than 100 microns in diameter. These pollutants are usually, but not always discovered, in the microscopic examinations of the eyes done in the physician's office. Foreign body sensations are the most common symptoms associated with the effect of air pollution on the eye. Typical findings on microscopic examinations of the eyes include redness of the eye (Conjunctivitis), corneal inflammation (Keratitis), and conjunctival or corneal

foreign bodies.

Secondary air pollutants occur when two or more primary pollutants interact. The most notable is the photochemical action of the sun light on auto emissions that produce non-atmospheric ozone. The patient's usual complaints are irritation, tearing, and redness and findings on examination include conjunctival redness (Conjunctivitis) and corneal inflammation (Keratitis).

In addition to primary and secondary pollutants, which usually occur outdoors, are indoor pollutants which include organic chemicals given off by cleaning fluids, paints, pesticides, or building materials. The risk of indoor air pollution is increased because the air is sealed and ventilation is reduced to conserve energy. This condition is defined by the World Health Organization as "sick-building syndrome" (SBS). Eyes affected by indoor pollutants are defined as "office eye syndrome." As a result of this condition there is a high incidence of premature break up of tear film, absence of foam on the eyelid margin and conjunctival damage. Exposure to chemicals usually destroys the lipid layer of the tear film, this in turn would result in rapid evaporation of the liquid component and subsequently leads to the dryness of the cornea and the conjunctiva with eventual damage to the eye (Table 2).

In treating patients who suffer from the effects of air pollutants, doctors should advise elimination or removal

of the pollutant, if identifiable. Use of ocular lubricants or artificial tears dilute the pollutants and maintain tear film. Avoid the use of eye drops containing vasoconstrictors. Use of protective eye gear and improved ventilation in high risk areas contributes to the reduction of ocular disorders.

Environmental Causes Of Respiratory Disease

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The lung is the largest and most vulnerable organ continuously exposed to the environment. It is not surprising, then, that the respiratory disease is dominated by environmental factors. Recent research has documented the importance of relatively low levels of particulate pollution in the Western World in the aggravation of asthma and acute respiratory and cardiovascular mortality. In the developing world, exposure has been documented to very high levels of particulate pollution from wood and biomass fuels and, in some countries, including China, from burning coal in houses without proper chimney and ventilation. These high levels of particulate pollution explain the high mortality rates for acute respiratory disease (about 4 million death per year) in children under the age of 5 in many countries. Lesser effects include permanent reductions in lung function.

Sulfur dioxide combined with particulate pollution has remained a major problem in Easter Europe. In the industrialized West, photo chemical pollution resulting largely from automobile emission is believed to be responsible for adverse health effects,

and this problem has begun to emerge in such cities as Mexico City and Bangkok.

There is little doubt that the world wide occurrence of respiratory disease, a result of man-made environmental factors is enormous.

Noise: A Threatening Pollutant

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Our world is becoming increasingly noisier but noise pollution has yet to be included among our major environmental concerns. In addition to the adverse effect of high levels of sound on hearing ability, exposure to noise has been linked to stress-related health impacts such as hypertension, impairments in cognitive development and learning, sleep deficits, and mental stress. Yet, the studies linking noise and health are still too few and largely correlational, calling for more research to confirm or refute the relationship.

Without strong findings on health hazards of noise, there has been a reluctance on the part of many governments, including the United States, to support programs aimed at reducing noise levels. So far the public outcry to noise, especially the noises emanating from the airplanes flying over many communities, has failed to arouse appropriate government response. Thus, to combat this more visible pollutant, community groups have banded together to educate citizens on the dangers of noise and to lobby makers to deal with the ever-rising decibel levels that surround us.

April 24, 1996, marked the first International Noise Awareness Day spearheaded by the League for the

TABLE 2 Ocular Effects of Air Pollution	
• OFFICE EYE SYNDROME	
– Premature Break-up of Tear Film	
– Conjunctival Damages	
– Dry Eye Syndrome	

Hard of Hearing in New York City. What started out as a local conference on noise grew into an international program with cities across the United States partnering with cities in Canada, Europe and Asia in a program to alert citizens to hazards of noise and ways to quiet our surroundings. In New York City Major Giuliani marked the day's events with the proclamation and press conference in City Hall. It is hoped that the energy that drove the first International Noise Awareness Day continues as an international effort to abate the overwhelming sounds that surround us and threaten our health and well-being. It would also be desirable for all readers of this paper to enlist in this undertaking.

Although we talk of noise, we must recognize that the antithesis of noise is quiet. Quiet is a time we all need so that we can think, reflect and reason. Maybe in these more reflective moods, people will begin to realize that a world that is less noisy, less frenetic is also a world that is peaceful.

Urban Living and the Skin The Problems and the Solutions

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People tend to view dermatologic problems almost by definition as superficial because their appearance is on the surface of the body. In fact, problems of the skin are increasingly threatening to the quality of human life, and at times regrettable to life, itself. Many diseases of the skin are contracted largely as a consequence of our living in crowded, urban environments. As a dermatologist, I can say that as we increasingly live in cities,

we do experience negative consequences to our health.

How does the urban environment affect our skin?

1) We all know that small particulate pollution from the burning of fossil fuels used in transportation, manufacturing and power generation damages the lungs causing bronchitis, asthma, and cancer, but we don't all realize that these same particles irritate our skin, causing rashes and acne-like eruptions.

2) Added to our exposure to the irritants in outdoor air, as city dwellers we spend most of their time indoors in tightly sealed buildings where air is recirculated, concentrating chemicals from machines, furnishings and cleaning solutions as well as cigarette smoke (where smoking is permitted). Furthermore, a variety of infectious microorganisms may grow on the moist surfaces of air conditioners, ducts, filters and humidifiers, from which they may be widely distributed by ventilating systems.

3) Because we live in cities and are so much indoors, we actively seek the sun during our leisure and vacation time. As a result of the decreasing stratospheric ozone caused not only by the natural solar cycle of ultraviolet light output but also by such destructive man-made pollutants as chlorofluorocarbons and halone, there is increased ultraviolet radiation damage with sun exposure causing premature aging of the skin, UV-induced diseases, increased infections of the skin, and an alarming increase in the incidence of skin cancer.

To minimize damage from ultraviolet radiation, it is important to avoid over-exposure to the sun. For the long term, we must also prevent further depletion of our protective shield, the ozone layer. Through some alterations of our habits, we can avoid or at least mitigate the sometimes serious skin problems which may otherwise affect our

everyday life.

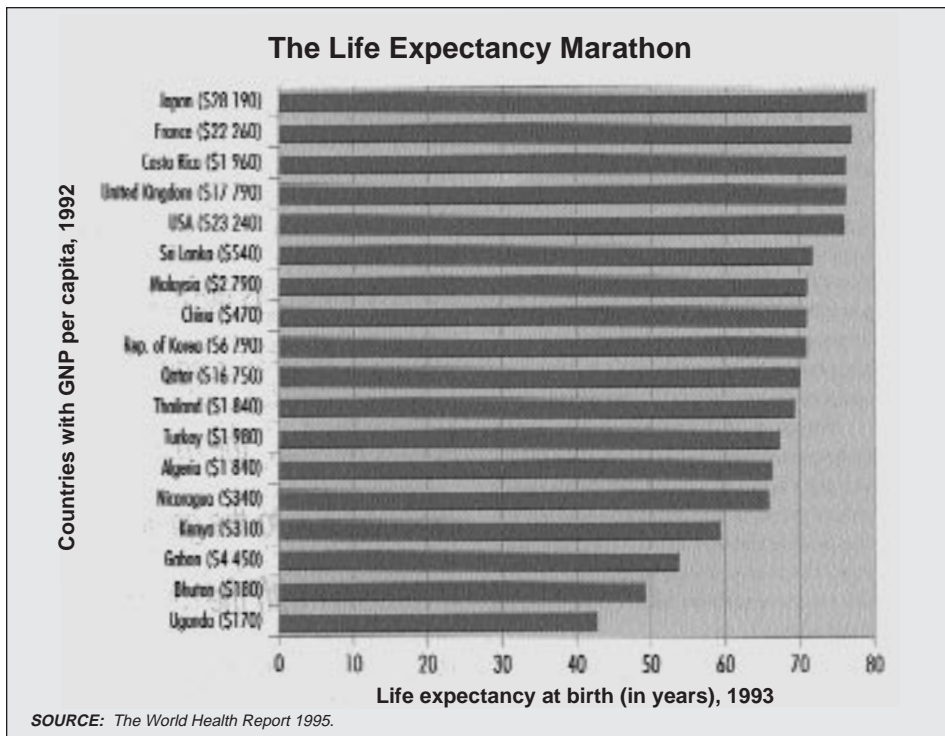
The Limitation of Population Growth on Nutritional Sufficiency for the Future

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Charleston, MA*

I am concerned when nutrition for the future is discussed out of context with the problem of the world's human population explosion. With population close to 6 billion today, it is estimated that the present generation will be the first to experience a doubling of the world's population during their life time. Thus the problems confronting nutrition are not simply the assurance that all the nutrients required for health are present within a diet, but the more basic issue of simple caloric adequacy to prevent mass starvation and deaths.

Most lands fit for agriculture are already being farmed intensively. Rather than more land being available for the future, soil erosion and destructive farming practices are destroying current agricultural areas. Global warming, sea level increases, increased UV at the earth's surface, and pollution of the environment are already taking their toll of agriculture productivity. With grain production per capita already falling in Africa and with the growing affluence of China with its increasing imports of grain, world grain prices will rise, making food scarcities in some developing countries a serious reality. But hunger leads to political unrest, revolutions, wars, refugees and distractions from peaceful productive farming pursuits.

Thus, the combinations of limited land and water resources for food production, increasing numbers of people



to feed the nutritional requirements of millions or hundreds of millions will go unmet. The consequences of this interdependent nutritional-population problem are likely to have dire consequences to human civilization unless effective measures to address these issues are soon forth coming.

Effectiveness of Global Environmental Health Policies: The View From Africa

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We have developed a mistaken notion that environmental health factors play an important role in setting global policies. The presentation examines the strengths and weaknesses of the voices of the health community. Environmental health factors are considered pertinent to setting general

policies within the health sector itself, and to a lesser extent, for environmental policies. As a whole, current research seems to accentuate pollution abatement, and be going ever inward instead of looking at the multidisciplinary dimensions of most problems. The main conclusions are that the current emphasis on pollution control may be giving a false sense of security of achievement in global environmental health improvement, at the cost of lack of attention to traditional environmental health factors that are still so common throughout the developing countries.

How can we redress the imbalance of an excessive focus on pollution? An ongoing World Bank study, "Bridging Environmental Health Gaps" (three volumes), is a first step. It's no secret that most causes of disease, injury and death in developing countries—inadequate sanitation, poor personal hygiene, road accidents, tobacco smoke, pollution—lie outside the control of the health sector. Yet, the policies of sectors that exert these direct

health impacts are not set by health criteria. The study helps identify opportunities to improve health in Bank operations outside the health care system, namely, through infrastructure interventions (i.e., water supply, sanitation, drainage, housing, urban development, transport, telecommunications). Each Volume has a separate message based on its emphasis.

- The Main Report (Volume I) is directed toward project management, based on 203 Sub-Saharan Africa (SSA) infrastructure projects (1984-94) and 300 Bank documents. It contains background on environmental health and a checklist which details how projects can help relieve the burden of disease. *Volume I reveals that consideration of environmental health in Bank projects has been minimal to date.*

- Volume II is a cross-sectoral literature review of about 2,000 works. Whereas Volume I summarizes infrastructure lessons, Volume II discusses each sector. *The literature indicates the limited role health has actually played in determining policies outside of the health sector.*

- Volume III looks at the role of environmental health in sustainable development and contains recommendations. It identifies significant issues that have not yet been resolved within the Bank, and cites the possibility of going against the first dictum of public health—that remedial measures do no harm—even for well intentioned projects:

- cut-and-paste science inevitably leads to cut-and-paste priorities;
- unclear sectoral responsibilities lead to incomplete solutions;
- sustainable development notions are confused with sustainable pollution abatement.

Leaving the door open for potential negative health repercussions is not sustainable development, even though it might be an admirable attempt at

sustainable pollution control. In economic terms, to overlook environmental health is equivalent to setting national energy policies based exclusively on capital-city gasoline consumption, without any discussion of secondary cities, rural areas, agricultural/industrial users, coupled with their elasticities and externalities.

An innovative feature of the above study was to base the analysis on potential for solutions, as opposed to the more traditional approach of the incidence and prevalence of the problems. Thus, the study showed the untapped power of interventions outside the health sector at improving health. In Sub-Saharan Africa, the top five burdens of disease are malaria, injuries, respiratory illness, diarrheas, tropical cluster (i.e., vector-related diseases), and the childhood cluster (mainly perinatal conditions). Collectively, these account for nearly half of the total burden of disease, as measured in Disability-Adjusted Life Years (DALY), a socioeconomic measure of human suffering combining morbidity and mortality factors. In fact, thumbnail calculations showed that about 44% of the total burden of disease is amenable to infrastructure improvements. In other words, for all but the childhood cluster, infrastructure project interventions potentially could have a substantial impact, perhaps even greater than health sector interventions. A wide range of potential interventions exists for targeted collaboration among the ministries of health and agencies which provide various public and private services. These areas of collaboration should be explored. In addition, the economic impact equivalent to the thumbnail of 44% for infrastructure interventions should be applied to other sectors, particularly agriculture and energy. Their potential repercussions are also potentially enormous, but the linkages to

environmental health have been poorly studied. It is hoped that further study on such linkages will allow us to speak of an "estimate" rather than a "thumbnail calculation."

Health Effect Assessment of Toxic Waste and Community Involvement

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Scientists from Government Agencies seek to understand the history of exposure and the potential effects of exposure to radiation and toxic waste on human health. They also try to respond to community and worker concerns about such exposures. To fully understand these issues, the Department of Energy (DOE) and other Federal Agencies are committed to working directly with communities to address their health concerns. Forming the base of this commitment are efforts to establish a bond with communities and to collaborate with them in addressing the complex issues associated with exposure to radiation and toxic waste released from DOE facilities and industry.

People directly affected have a basic right to have a voice and vote in decision making, planning, monitoring, problem solving, implementation, and evaluation in their community public health activities. The public can be involved by two-way communication and open, honest sharing of information by all parties.

To address individuals' health concerns, the Government Agencies should develop partnerships with other organizations, provide information

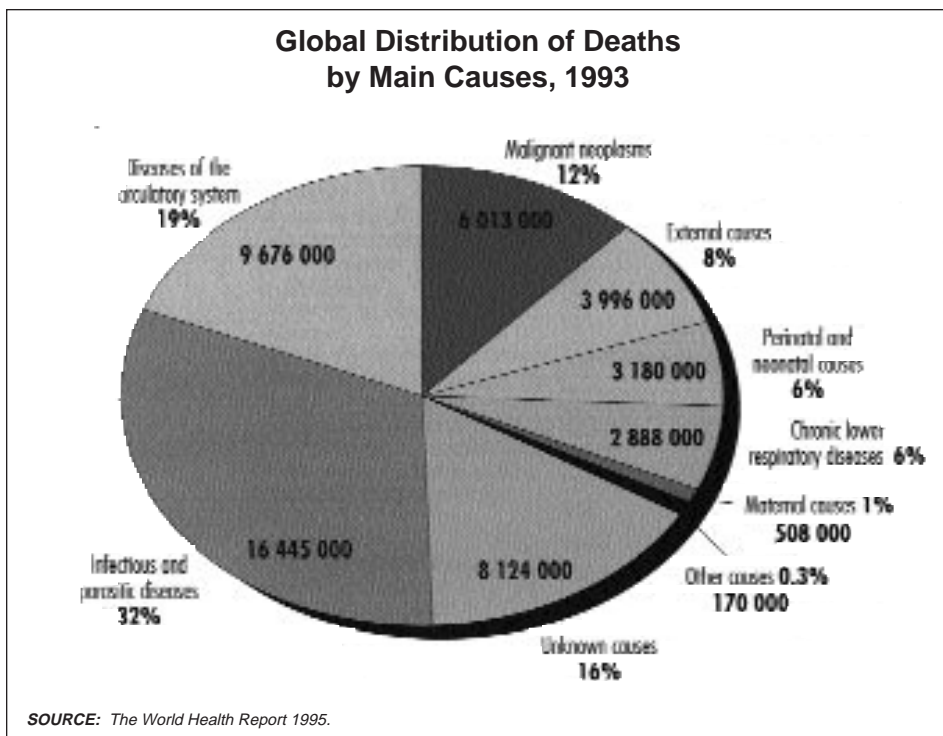
about organizations that can be used as resources, and establish grants to State and local health departments to provide incentives for working on issues confronting the communities. Key topics are education and training for communities, outreach to culturally diverse populations and public participation in decision making.

Occupational Health Hazards

*Maritza Tennassee, MD
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Hazardous waste, produced by industrial and health care facilities, is one of the important occupational and environmental issues of our time. In the Region of the Americas, despite the economic uncertainties of the past decade, demand for and the use of products derived from natural and synthetic chemicals have continued to expand since mid-century. Today there are few aspects of modern society that do not make an ever increasing demand on consumer goods, household and agricultural chemicals and services including very advanced forms of medical care. The results of this scientific and technological progress, as measured by a general increase in the quality of life, has not only benefited mankind but is also beginning to create an increasing awareness of the hazardous consequences on the environmental quality.

The general environment reflects the state of the workplace. Toxic chemicals, radioactive material and other harmful substances used at work are regularly dispersed into the air, water, soil and biota. Global awareness has been shaped by such events as



Chernobyl, Bhopal, Seveso, Minimata and the damages caused by DBCP and Asbestos.

So today environmental effects are seldom local, particularly with the growing economic integration in the Hemisphere. GATT, HAFTA, MERCOSUR, ACS, and other trade agreements between various Latin American countries have transformed the workplace into a microcosm as a global reality. It is a microcosm where social, economic, political, biophysical, chemical and ergonomics factors combine and work together to determine the health status of the workers, their families and society as a whole.

The growing concerns related to the production of a large variety of waste material by all sectors of the economy, is not only because of the ever increasing quantities that are being produced, as countries continue to develop, but also the potential impact that improper disposal of these toxic materials may have on human health. Presently, the major health concerns are: 1) sudden

increases of specific adverse health effects (e.g., number of congenital malformations, birth defects, increase sterility, etc.) that are suspected to be related to increased levels of particular toxic substance (or substances) in the air, water, food or soil in particular areas; and 2) hidden exposures, of which people are not aware to be in contact with, and that could possibly lead to irreversible disease processes (e.g. cancer).

The purpose of this presentation is twofold: 1) to present a general overview of the various aspects of hazardous waste as they relate to occupational health; and 2) to present the results of a survey of hazardous waste production arising from industrial and health care activities carried out in 21 Latin American and Caribbean Countries. The study forms part of the Pan American Health Organization (PAHO) Regional Program on Hazardous Waste Control, which serves to support and strengthen the capacity of countries in the Region to

deal effectively with hazardous waste problems, and thus protecting human health and the environment.

Community Implications of Hazardous Waste Sites

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Almost no one ever chooses to have a hazardous waste site in their community. But contaminated properties are actually far more prevalent than indicated by the numbers cited by public officials would suggest. Their generation was usually not authorized; typically no trusted human process was involved in their creation or current disposition. Secrecy shrouds them. Once identified, then, they almost invariably create a sense of mystery and awe of the unknown, the unfathomable and the sinister. Their impact seems to fall unequally on parts of the community—their location is too regularly proximate to the powerless. Expert opinion is routinely rejected. These characteristics explain why the community implications of hazardous waste sites are not simply negative but paralyzing and force us back to first principles.

The fundamental principle authorizing decisions in democratic societies is informed consent. In order to become informed, I must first be able to understand the information or data about the issues with which I am concerned. Secondly, once informed, I have got to believe that the path forward is one that represent an improvement over the present circumstance or affliction in order to give my consent.

How do *communities* give consent? One concept is that they utilize



L to R: Dr. Steven Esrey; Minister of Health of Lebanon, Excellency H.E. Marwan Hamadeh; Dr. Bernard D. Goldstein; Dr. Christine Durbak; Dr. Charles Powers; Dr. Maria Pavlova
United Nations N.Y. April 25, 1996

informed consent to delegate; by majority, they elect people to decide. Yet, simple reliance on the decisions of democratically-elected officials, typically fails at waste sites (*usually*, not just sometimes, an aroused public literally freezes the political process—politicians rarely decide to change the present circumstance). Another concept for authorizing decisions is consensus (the agreement of all the affected parties). Consensus of the affected parties has been proposed as the goals to authorize decisions at DOE waste sites but has yet to prove either possible or effective.

But, out of the ashes of the nation's struggle with hazardous waste sites has recently emerged something fundamentally new: the concept that cleaning up and reusing contaminated property is itself the catalyst to energy, synergy and community commitment to results far broader than dealing with the contamination per se. Hazardous waste sites are actually moving to the center of the initiative to revitalize urban areas and preserve resources. This presentation explores the dynamic represented by this transformation of hazardous waste sites from confounder to catalyst of community, where it is happening and why.

The community implications of hazardous waste sites are being transformed if we are adept enough to remember first principles and manage to give them life in complex situations. For those who both evaluate and manage risk, the implications for when and how their findings can be heard and used are similarly revolutionary.

Can Neighborhood Quality in Devastated United States Cities be Improved

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Bloustein School
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New Brunswick, NJ*

Everything we see, smell, feel, or hear that disturbs us when we walk outside our home is a neighborhood environmental problem. This includes criminal activity, blighted buildings, litter, noisy neighbors and pollution. Like many other nations, however, the United States has ignored this reality in favor of a definition of environment that equates environmental risks with air, land and water pollution. Crime, blight, transportation and other prob-

lems are left to other agencies. And in the United States these other federal agencies, their state progeny, and the U.S. Environmental Protection Agency (EPA) and its state counterparts hardly talk to one another.

This disconnect is not a major problem in most American cities and towns because almost 70 percent of Americans do not identify a single problem in their neighborhood. If there is a local transportation problem, the transportation agency can usually fix it with a little help from a few other agencies; a ground water problem can normally be solved by the environmental agency; and so on.

Yes in some city neighborhoods, residents identify 5 to 10 major environmental problems. It is in these "multiple-hazard" neighborhoods where our lack of communication and real inter-agency cooperation causes problems. In these neighborhoods, problems are so serious and interconnected that it is essential that government agencies work together and with local residents. However, the U.S. and state governments do not even estimate cumulative risk in these beleaguered places. We cannot set priorities for actions unless we understand the full extent of environmental risks in these neighborhoods. It is also clear that local health and environmental officials and local residents are far more knowledgeable about the problems of multiple hazard neighborhoods than experts sitting in Washington, D.C. and in state capitals who control budgets and policy.

The net results of our current policies are piecemeal and uncoordinated efforts to address risk. These are not cost-effective and fail to improve neighborhood quality. There is no single agency that can play the heroic knight and save these stressed neighborhoods. What is needed is a joint effort by government agencies, businesses and communities to find realistic and effective ways to improve

neighborhood quality in these multiple-hazard neighborhoods.

Elimination of Toxic Industrial Wastes Through Effective Environmental Management

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Environmental & Manufacturing Consulting
Services, Toronto Canada*

The achievement and demonstration of sound environmental performance by North American industry is becoming increasingly more important in today's competitive environment. Factors such as liability issues, tightening regulations, economic policies supporting environmental protection, and the general awareness and growth of concern amongst stockholders, particularly regarding sustainable development, have all contributed to an increased interest in the effective management of environmental issues. At the same time, traditional "command and control" approaches to the regulation and cleanup of toxic industrial wastes have largely proven ineffective, due to high administration costs, excessive litigation, and technical difficulties in treating hazardous contaminants after they have been generated.

Such methods have been abandoned throughout many jurisdictions in North America, and replaced by environmental management systems using a proactive approach known as pollution prevention. Pollution prevention provides the opportunity for regulatory authorities and industry to work jointly to minimize toxic discharges to the environment before they occur, reducing the need for costly enforcement programs. It also provides industry with the means to optimize manufacturing

processes, reduce operating expenses, minimize health risks to employees and the general public, and minimize long-term liability.

In order to be truly effective, pollution prevention initiatives must be conducted within a structured management system and integrated with overall management activity. An environmental management system involves establishing the organizational structure, responsibilities, practices, procedures, processes and resources for implementing and maintaining environmental performance. Its purpose is to protect human health and the environment through minimizing the impact of a company's activities, products and services on the environment.

The International Organization of Standardization environmental management system standards, known as ISO 14000, are presently in the final stages of development, and are scheduled to be published in the fall of 1996. These standards were developed by a Canadian-led international technical committee, through consultation with both government and industry, and are the world's first set of international environmental management standards. The purpose of ISO 14000 is to provide a standardized benchmark for the planning, implementation, monitoring, and continuous improvement of environmental management systems.

Achieving and maintaining competitiveness with the ability to balance and integrate economic and environmental interests are the desired long-term results of an effective environmental management system. The European Community is presently considering adopting ISO 14000, and international trade bodies such as the World Trade Organization are reviewing the standards as a possible solution to the problem of country-specific environmental requirements being used as

trade barriers. As was the case previously with the ISO 9000 quality standards, ISO 14000 environmental management system certification will likely become a requirement of doing business, particularly at the international level.

Biodiversity Prospecting: Using Biodiversity to Promote Human Health, Conservation and Sustainable Development

*Edgar J. Asebey, President
Andes Pharmaceuticals, Inc.
Washington, D.C.*

Biodiversity prospecting is the search for useful pharmaceutical compounds locked within the world's biological diversity. This approach to discovering new pharmaceuticals is not new; 40% of all modern pharmaceuticals are derived from natural products (i.e., biodiversity). Annual world wide sales of plant-derived pharmaceuticals currently total \$20 billion. Furthermore, an impressive 70% of all plants known to have anti-tumor properties which may lead to breakthroughs in treatment of cancer have been found in tropical forests. Yet of an estimated 60,000 species of plants in the Amazon, a mere 470 have been studied chemically and an astonishing 90% have not yet been subjected to even a preliminary analysis.

The search for new natural products has traditionally implied the exploitation of the resources found in a developing country and the subsequent removal of that resource to a developed country for investigation and eventual commercialization. As a result of this "extractive" approach to biodiversity prospecting, very few benefits

have been returned to the developing countries which are the source for these natural products.

A new approach recently put forth replaces the traditional "extractive model" for biodiversity prospecting with the "partnership model." Under the "partnership model" no natural products are removed from the country of origin. Instead, the biotechnology and know-how necessary to discover new pharmaceutical entities are transferred to the developing country rich in biodiversity such that more "value-adding" may be performed within the developing world. This is done through a partnership or joint venture between a biotechnology company from the North and collaborating institutions, NGOs, and local indigenous communities in the South.

This talk focuses on the tremendous opportunities which may be created for the developing world when the "partnership model" for biodiversity prospecting is implemented. Some of these advantages include improving human health, supporting a scientific capacity-building, promoting conservation and sustainable development, and more equitably sharing the benefits derived from the South's biodiversity.

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POINT OF VIEW: *Health and Development*

Prospects for improving both the environment and people's well-being are closely linked with reviewing and adjusting the development model, which may help end economic stagnation by allowing greater freedom and democracy, promoting better care and protection of the various ecosystems, and fighting inequality.

Developing countries with rapid urbanization are undergoing enormous social and economic changes. Paradoxically, the same pattern of behavior that produce progress often create environmental problems, that offset some of these achievements and may result in long-term deterioration. The potential health effects of environmental deterioration are becoming major items on the agenda of governments. There is growing recognition that development models have contributed to the intensification of poverty and habitat destruction inadvertently offering new opportunities for lethal microbes to infect the human population. (See *World Ecology Report*, Winter 1995).

Zaire's leading virologist suggests that outbreaks of the Ebola virus in Africa might be connected to environmental damage in the interior of the African forest because Ebola outbreaks seem to be associated with ecosystem

disturbances. The virus appears to lie dormant in the forest until logging or some other activity stimulates the microbe. The source of Ebola has not been discovered but it has been suspected to reside somewhere in a host in the African forest. [WHO Press Release, H/2899 Feb. 20, 1996]. Ebola cases have been confirmed in Gabon, Ivory Coast and Liberia. Because of its mystery and its extremely high fatality rate, Ebola has attracted more attention than meningitis and malaria, diseases endemic to Africa which kill many more Africans annually than any Ebola outbreak has. (Reuters March 6, 1996).

Patterns of social and economic development differ between industrialized and underdeveloped countries. The most striking difference is that industrialized societies are largely consumer-oriented, relying on the mass production of goods and services, where as underdeveloped countries are essentially based on resource exploitation, relying on agriculture, mining, forestry, and other natural assets to raise the standard of living. Both approaches have potentially serious but quite different impacts on the environment and on health. In developing countries, the pressures of poverty and population growth force people to cultivate ever more marginal

lands. This cultivation further erodes the thin soil and depletes shallow water resources, creating even greater poverty as crop yields fall and women spend more of their day searching for firewood and fetching water. In the industrialized countries energy consumption results in the emission of 6 billion metric tons of greenhouse gases into the atmosphere each year, even though these countries have only a fifth of the world's population.

Three quarters of the poor people in the South live in ecologically fragile areas. It is estimated that at least 14 million have become environmental refugees, driven from their homes by ecological degradation. A recent report of the World Bank stated that "more than a billion people—about one third of the total population in developing countries—live in poverty. Despite progress, as measured by aggregate per capital consumption and improvements in social indicators (in some countries), poverty increased in many countries. Further, the United Nations Development Program recognizes that "human development is moving to center stage in the 1990s. For too long, the question has been: How much is a nation producing? Now the question must be: How are its people faring?"

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