Philippines

ENVIRONMENT

MONITOR 2006

Environmental Health

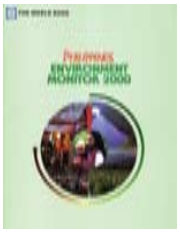
http://www.worldbank.org.ph/pem

The World Bank Group

1818 H Street, N. W.
Washington D. C. 20433, U.S.A.
Tel: 202-473-1000
Fax: 202-477-6391
www.worldbank.org

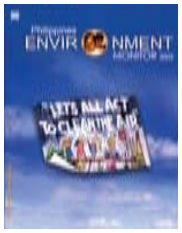
Country Offi ce Manila
23rd Floor, The Taipan Place
F. Ortigas Jr. Ave. (formerly Emerald Ave.)
Ortigas Center, Pasig City, Philippines
Tel: 63-2-637-5855 to 64
Fax: 63-2-637-5870; 917-3050
www.worldbank.org.ph

June 2007



The Philippines Environment Monitor 2000 *presented snapshots of the general environmental trends in the country.*

The Philippines Environment Monitor 2001 *on solid waste management.*



The Philippines Environment Monitor 2002 *on air quality.*

The Philippines Environment Monitor 2003 *on water quality.*

The Philippines Environment Monitor 2004 *provided updates on the state of the Philippine environment and natural resources.*

The Philippines Environment Monitor 2005 *on coastal and marine resource management.*

This document was prepared by a World Bank team composed of Jonas Bautista, Marija Kuzmanovic, Mikko Paunio, Tamer Rabie, Jitu Shah, Maria Consuelo Sy, Maya Villaluz, and John Morton (Task Team Leader). The document greatly benefted from the input of the following World Bank staff Anjali Acharya, Yewande Awe, Kulsum Ahmed, Christopher Ancheta, Eduardo Banzon, Edkarl Galing, Timothy Johnston, Peter Kolsky, Jostein Nygard, Jemima Sy, and Josefo Tuyor. Special thanks to Magda Lovei, Maria Teresa Serra, Susan Shen and Joachim von Amsberg for their input and support during preparation. The document was developed through consultation with many government agencies, NGOs, international partners and practitioners in the Philippines, which contributed significantly to its messages and storyline. Comments from DENR-Environmental Management Bureau (EMB) Water Quality and Air Quality Management Divisions; WHO Philippines; and DOH-Environmental and Occupational Health Office (EOHO) during the finalization were especially useful in sharpening the document and messages. Special thanks to Director Yolanda Oliveros (EOHO) and Director Ely Ouano (EMB) for their input and support.

Background information and data collection and initial drafting was undertaken by two consulting frms, INTEM and Getinsa. The INTEM team was composed of Dr. Elma Torres, Dr. Ronald Subida, Dr. Agustin Arcenas, Ms. Bernadette V. Gonzales, Mr. Joel Wayne Ganibe, Ms. Jeannette V. Pastorfide, Arman G. Balonkita, Henrietta V. Aguirre, Atty. Ana Leah Uy, and Mr. Soichi Takai. The GETINSA team included Dr. Ben S. Malayang III, Marisol Garrido, and Joel D. Adriano.

Table of Contents

Preface

THE PHILIPPINES ENVIRONMENT MONITOR series has been providing a snapshot of key environmental trends and indicators in the country for the past seven years. Its aim is to inform a broad range of stakeholders, including government, the public, practitioners, and educators in a simple, easy-to-understand format. Over the years, the *Environment Monitor* series has covered general environmental trends as well as specifi c topics such as water quality, air quality, coastal resources, and solid waste management. The latest *Environment Monitor* investigates environmental health in the Philippines.

Every day people are exposed to different environments with different characteristics. Air quality, drinking water quality, sanitation conditions, and urban congestion are just a few examples of characteristics of the environment that can affect health. While the link between environment and health has been known among scientists and practitioners for at least a century, it is only in the past few years that it has been quantifi ed. Globally, it is estimated that 24 percent of the disease burden and 23 percent of premature deaths could be avoided through a better environment. This impact is especially high for children as worldwide each year four million children die prematurely due to environmental factors.[1]

The *Philippines Environment Monitor 2006* is intended to bring greater attention and insight into the effect of the environment on health in the Philippines. It focuses on how air pollution, water pollution, sanitation conditions and hygiene practices affect the health of the country, and highlights what is being done to reduce health risks through a better environment. It is comprised of six sections: (1) an introduction to environmental health in the Philippines; (2) the disease burden and environmental risks of water pollution, sanitation and hygiene; (3) the disease burden and environmental risks of air pollution; (4) the effect of environmental health on the poor and vulnerable; (5) the institutional and regulatory framework; and (6) the management response. The document concludes with a set of challenges for the Philippines as it moves forward on this agenda.

The document is a joint exercise among the Government of the Philippines and the World Bank. It was developed with the participation of national agencies, health practitioners, academia, and civil society. It will be disseminated widely throughout the Philippines and through regional and national workshops on water, sanitation, and air quality.

Rahul Raturi
Sector Manager
Rural Development, Natural Resources
and Environment Sector Unit
East Asia and Pacifi c Region
The World Bank

Maryse D. Gautier
Acting Country Director, Philippines
East Asia and Pacifi c Region
The World Bank

[1] WHO, 2006b.

Executive Summary

THE QUALITY OF the environment that Filipinos are exposed to in their home, work. and throughout their daily lives is affecting the health of the country. Air pollution, water pollution, sanitation and hygiene practices are the most significant environment-related health risks in the Philippines, accounting for an estimated 22 percent of the reported disease cases and nearly six percent of reported deaths and costing PHP14.3 billion (US$287 million) per year in lost income and medical expenses. Reducing this disease burden and capturing the health benefi ts of an improved environment necessitates the involvement of a broad range of stakeholders and strong public interventions that can effectively address issues including the protection of public goods through environmental management, provision of basic needs, and changing individual behavior through awareness. The *Philippines Environment Monitor 2006* is intended to provide government offi cials and decision makers, NGOs, practitioners, and the general public an overview of the health impacts and risks as well as ongoing environmental health initiatives. It also provides a set of proactive challenges that can be used as a stepping stone for further action.

Water Pollution, Sanitation and Hygiene. In the Philippines, exposure to water pollution and poor sanitation conditions and hygiene practices account for one-sixth of the reported disease cases and nearly 6,000 premature deaths per year. The cost of treatment and lost income from these diseases amounts to PHP6.7 billion (US$134 million) per year. Diarrhea, which is one of most prevalent disease in the Philippines, is the most common health impact. Intestinal worms are similarly ubiquitous with studies fi nding them in over 40 percent of children. Typhoid and cholera outbreaks are also common. The major cause of these diseases is poor sanitation and hygiene in the household. Currently, 25 million people lack basic sanitation and 13 million lack water sources that can provide improved drinking water and hygiene. Another risk is from the fact that nearly all the domestic wastewater in the country is untreated, which can expose people to parasites, pathogens, and bacteria in water supplies, agricultural fi elds, drainage systems, and surface water.

Fortunately, over the past 15 years there have been important improvements. Since 1990, the proportion of the population with access to basic sanitation has increased from 57 to 72 percent. Access to household water supply connections, which has been shown to increase the amount of water available for hygiene purposes, increased from 26 to 40 percent nationally and is now at 58 percent in urban areas. At the same time, over the last ten years the incidence of several water pollution-related diseases has declined substantially. Reported diarrhea incidence has decreased by 43 percent and hepatitis A has dropped by 70 percent. Reported incidence of schistosomiasis, a disease that uses a snail intermediary and is spread through exposure to human waste, has also dropped substantially (40 percent), and is contained to a few regions.

These improvements, however, have not occurred evenly in the country. In particular, the Autonomous Region of Muslim Mindanao (ARMM) has the highest reported incidence of water pollution, sanitation and hygiene-related diseases in the country. The proportion of the population in the ARMM with access to improved sanitation (38 percent) is just over half the national average. Similarly, the proportion of the population in the ARMM with access to improved water sources is lowest in the country (60 percent) and 15 percent lower than in any other region. The disparity across income levels in the country is also striking. The proportion of low income families with access to basic sanitation is 22 percent lower than high income families and the proportion with access to water sources that can provide improved drinking water and basic hygiene is 17 percent lower.

Air Pollution. Poor air quality from outdoor air pollution in urban areas and indoor air pollution is also affecting health, accounting for an estimated fi ve percent of all reported disease cases and four percent of all reported deaths in the country. Air pollution primarily causes respiratory diseases including acute and chronic bronchitis, pneumonia, and cardiovascular diseases. The impact on the economy from health expenditures and lost income is estimated to be PHP7.6 billion (US$153 million) per year.

Levels of particulate matter—a signifi cant health concern and indicator of high levels of other pollutants—are estimated to be on average three times higher in urban areas than in rural areas. Over 18 million people in the Philippines live in cities with unhealthy levels of airborne particulate matter. Due to its large population and high air pollution levels, Manila has the largest health burden from air pollution. Eighty-four percent of particulate pollution is from motor vehicles, particularly motorcycles, tricycles, and utility vehicles such as jeepneys.

Indoor air pollution is a health risk in both urban and rural areas, but the extent of the impacts are not fully understood. Forty-six million people in the country use fuelwood for cooking, which increases their risk of exposure to particulate matter, polycyclic aromatic hydrocarbons (PAHs), and carbon monoxide in households and kitchens. Tobacco smoke is another contributor to indoor air pollution and 56 percent of school children have parents that smoke.

Several trends and interventions over the past ten years have improved air quality. The closure of a number of coal-fired power plants near Manila in 2001 has led to a reduction in sulfur dioxide concentrations. In addition, the phaseout of leaded gasoline has led to a ten-fold reduction in ambient lead levels since 1990. More recently, the implementation of the Clean Air Act has introduced fuel standards that would reduce aromatics and benzene in gasoline and the sulfur content of automotive diesel fuel. In 2003, the government also established hydrocarbon emission standards for motorcycles and tricycles in urban and rural areas and began requiring emission testing before registration of motor vehicles. In terms of indoor air quality, over the last ten years, people have been switching from traditional solid fuels to the cleaner burning liquefi ed petroleum gas.

Moving forward, the high disease burden underlines the key role of environmental improvement in the health of Filipinos. Addressing this issue will necessitate a multi-pronged approach grounded in effective public interventions and broad stakeholder involvement. Among the key elements are commitment and coordination among government agencies; effective use of information by the government and public; improved infrastructure; and effective regulation. The priorities for immediate action include:

Raising the profile of the environment's role in health in government programs and policies and strengthening the institutional commitment to the agenda through the Interagency Committee on Environmental Health.

Providing useful and easy to access information through more timely and complete disease surveillance, improving awareness materials and providing effective mechanisms for information sharing and dissemination.

Improving infrastructure for health by filling in the gaps in basic sanitation, expanding water resource development, and reducing the health risks of polluted surface and groundwater.

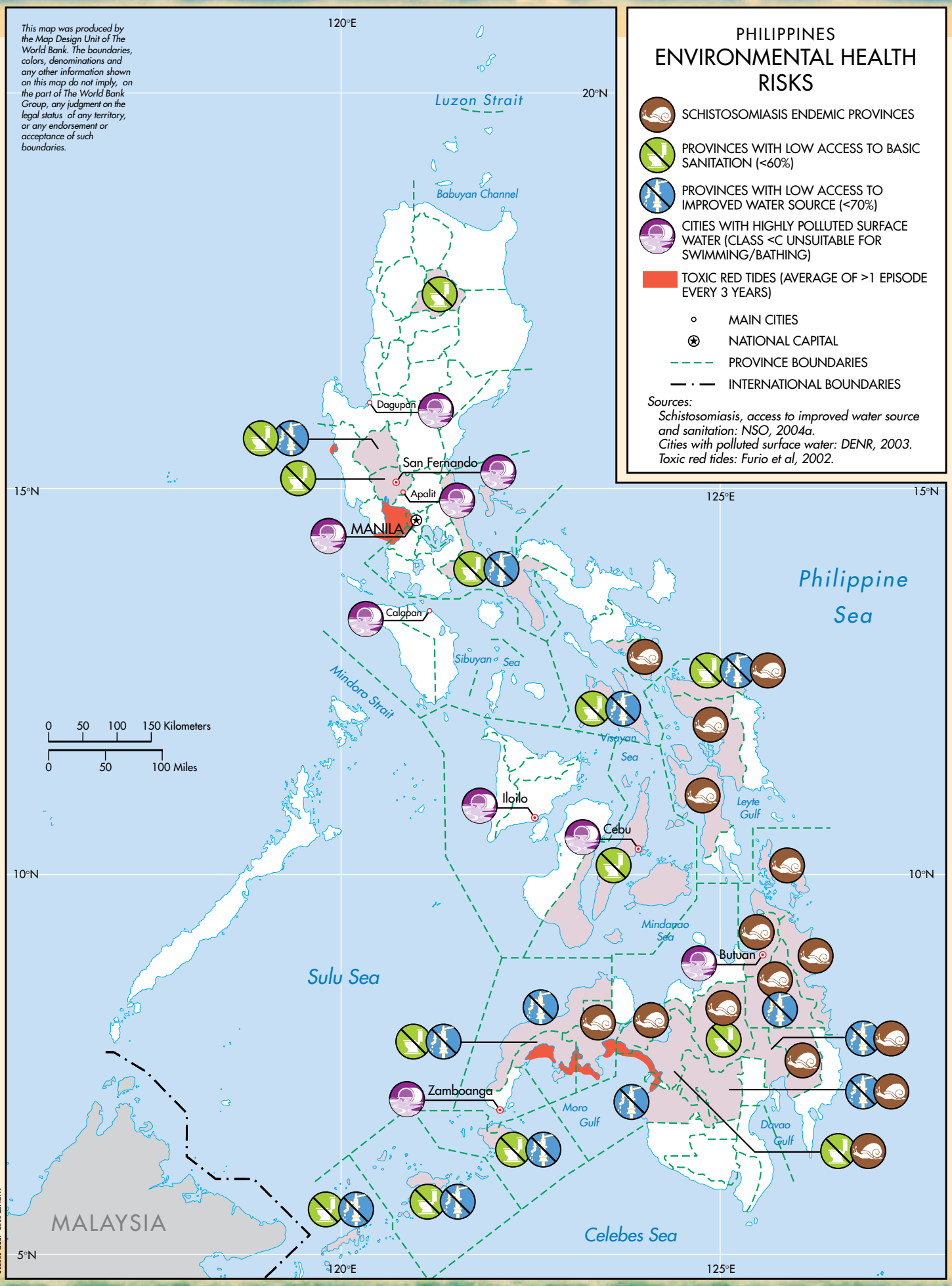
Improving regulation by strengthening local regulation and reducing particulate matter emissions from motor vehicles.

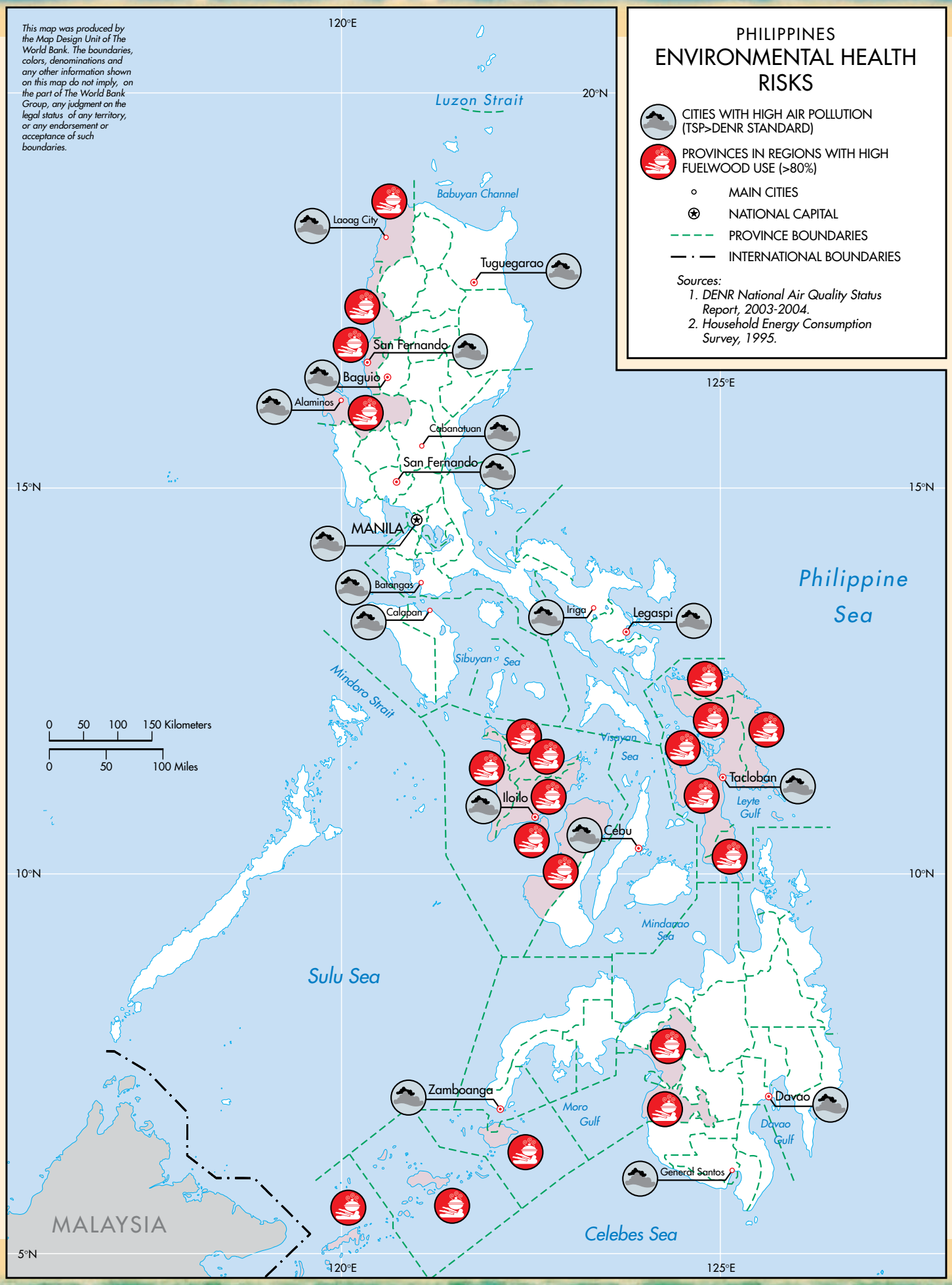
Taking the agenda forward using the finalization of the National Environmental Health Action Plan as a stepping stone for commitment and action.

Scorecard

ENVIRONMENTAL HEALTH SCORECARD: RISKS			
Indicators	**Number of people exposed and relative risk**	**General Trend (downward trend indicates reduced risk of disease)**	**Status and Comments**
WATER: ENVIRONMENTAL RISKS			
Lack of access to improved sanitation	**25 million people** **Very high risk** This is exacerbated by the fact that 45 percent of Filipinos do not wash their hands after using sanitation facilities		Sanitation access has increased 15 percent nationally since 1990; on track to meet Millennium Development Goals
Lack of access to improved water sources	**13 million people** **High risk** Commonly contaminated water supply systems add to this risk		The percent of population without access to improved water sources is increasing; not on track to meet Millennium Development Goals
Lack of sewerage coverage in urban areas	**37 million people** **Medium risk** Risk is high for those in contact with open drainage or waterways		Sewerage coverage has increased slightly over the past few years due to investments in Manila.
Lack of septic tank maintenance	**42 million people** **Medium risk** Reduces sanitation in households and contributes to contaminated water supplies, drainage systems, and waterways		Septic tank maintenance programs in Manila are gaining momentum.
AIR: ENVIRONMENTAL RISKS			
Particulate matter concentrations in urban air above DENR standards	**18 million people** **Medium-high risk** Risk is high for those exposed to traffic much of their day		Has decreased slightly over the past ten years in Manila.
Use of fuel wood for cooking	**46 million people** **Level of risk unknown** Depends upon degree of ventilation		Use of wood has decreased from 64 percent in 1995 to 55 percent today.
Smoking in households	**30 million Filipinos smoke and 56 percent of children** have parents that smoke		Exposure to smokers at home remained constant between 2000 and 2003.

ENVIRONMENTAL HEALTH SCORECARD: DISEASE BURDEN			
Indicators	**Disease Burden**	**General Trend (downward trend indicates reduced disease burden)**	**Status and Comments**
WATER: DISEASE BURDEN			
Diarrhea	16.5 percent of reported disease cases		Cases of diarrhea have decreased nationally by 43 percent over the last ten years
Cholera	0.1 percent of reported disease cases		Cholera outbreaks have reduced by half over the last ten years
Schistosomiasis	0.2 percent of reported disease cases		Schistosomiasis has declined by 40 percent over the last ten years nationally
Soil-transmitted Helminthes	An estimated 40 to 95 percent of school children are affected		Remains at similarly high levels as it did ten years ago
AIR: DISEASE BURDEN			
Cardiovascular and respiratory illnesses.	4.9 percent of reported disease cases		Overall, cardiovascular and respiratory disease incidence has changed little over the past five years; the trend of air pollution impacts on those diseases is not known.


This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
120°E
20°N
15°N
125°E
10°N
5°N
Luzon Strait
Babuyan Channel
Dagupan
San Fernando
Apalit
MANILA
Calapan
Philippine Sea
Sibuyan Sea
Mindoro Strait
Visayan Sea
Iloilo
Cebu
Leyte Gulf
Mindanao Sea
Butuan
Sulu Sea
Zamboanga
Moro Gulf
Davao Gulf
Celebes Sea
MALAYSIA
0 50 100 150 Kilometers
0 50 100 Miles
PHILIPPINES
ENVIRONMENTAL HEALTH RISKS
SCHISTOSOMIASIS ENDEMIC PROVINCES
PROVINCES WITH LOW ACCESS TO BASIC SANITATION (<60%)
PROVINCES WITH LOW ACCESS TO IMPROVED WATER SOURCE (<70%)
CITIES WITH HIGHLY POLLUTED SURFACE WATER (CLASS <C UNSUITABLE FOR SWIMMING/BATHING)
TOXIC RED TIDES (AVERAGE OF >1 EPISODE EVERY 3 YEARS)
MAIN CITIES
NATIONAL CAPITAL
PROVINCE BOUNDARIES
INTERNATIONAL BOUNDARIES
Sources:
Schistosomiasis, access to improved water source and sanitation: NSO, 2004a.
Cities with polluted surface water: DENR, 2003.
Toxic red tides: Furio et al, 2002.
AUGUST 2007 IBRD 35573R


This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
PHILIPPINES
ENVIRONMENTAL HEALTH RISKS
CITIES WITH HIGH AIR POLLUTION (TSP>DENR STANDARD)
PROVINCES IN REGIONS WITH HIGH FUELWOOD USE (>80%)
MAIN CITIES
NATIONAL CAPITAL
PROVINCE BOUNDARIES
INTERNATIONAL BOUNDARIES
Sources:
1. DENR National Air Quality Status Report, 2003-2004.
2. Household Energy Consumption Survey, 1995.
120°E
125°E
20°N
15°N
10°N
5°N
Luzon Strait
Babuyan Channel
Laoag City
Tuguegarao
San Fernando
Baguio
Alaminos
Cabanatuan
San Fernando
MANILA
Batangas
Calapan
Iriga
Legaspi
Philippine Sea
Sibuyan Sea
Mindoro Strait
Visayan Sea
Tacloban
Leyte Gulf
Iloilo
Cebu
Mindanao Sea
Sulu Sea
Zamboanga
Moro Gulf
Davao
Davao Gulf
General Santos
Celebes Sea
MALAYSIA
0 50 100 150 Kilometers
0 50 100 Miles
AUGUST 2007 IBRD 35577

Abbreviations & Acronyms

ADB	Asian Development Bank
ALRI	acute lower respiratory infection
ARI	acute respiratory infections
BOD	biological oxygen demand
BSWM	Bureau of Soils and Water Management
BWSA	Barangay Waterworks and Sanitation Association
CAA	Clean Air Act
CO	carbon monoxide
CO_2	carbon dioxide
COPD	chronic obstructive pulmonary disease
CWA	Clean Water Act
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Governments
DO	dissolved oxygen
DOE	Department of Energy
DOH	Department of Health
DOTC	Department of Transportation and Communications
DPWH	Department of Public Works and Highway
EIA	environmental impact assessment
EHS	Environmental Health Services
EMB	Environmental Management Bureau
ENRAP	Environmental and Natural Resources Accounting Project
FAO	Food and Agriculture Organization of the United Nations
FHSI	Field Health Service Information System
GDP	gross domestic product
HC	hydrocarbon
IACEH	Interagency Committee on Environmental Health
LGU	local government unit

LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MDGs	Millennium Development Goals
MMDA	Metro Manila Development Authority
MSSP	Manila Second Sewerage Project
MTPDP	Medium-Term Philippine Development Plan
MWCI	Manila Water Company, Inc
MWSS	Metropolitan Waterworks and Sewerage System
NCDPC	National Center for Disease Prevention and Control
NEC	National Epidemiology Center
NEHAP	National Environmental Health Action Plan
NEESSS	National Epidemiological Epidemic Sentinel Surveillance System
NGO	Nongovernmental organization
NOAEL	no adverse effect level
NOx	nitrogen oxides
NSO	National Statistics Office
NWRB	National Water Resources Board
NWRC	National Water Resources Council
O_3	ozone
Pb	lead
PHP	Philippine peso
PM	particulate matter
PM10	suspended particulate matter smaller than 10 microns
POPs	persistent organic pollutants
RfD	reference dose
SO_2	sulfur dioxide
STH	soil-transmitted helminthes
TSP	total suspended particulates
USAID	United States Agency for International Development
VOC	volatile organic compounds
WHO	World Health Organization

Chapter 1. INTRODUCTION

EVERY DAY, PEOPLE are exposed to different environments. Depending on where they eat, sleep, work, play, and how and where they travel, people breathe different air, drink different water, and are in contact with a variety of surfaces, soil, and even insects. The quality and characteristics of the environments people are exposed to can have important implications on their well-being. Environmental health (Box 1.1) as a discipline provides insight into the extent to which the environment affects health, and, more importantly, how the harmful impacts can be prevented by improving the quality of the environment we live in. This *Philippines Environment Monitor* uses available data and knowledge to provide a quantitative and qualitative assessment of this relationship in the Philippines.

Globally, environmental risks are responsible for one-quarter of all preventable diseases. Of the 102 major disease types and injuries, environmental risks contribute to 85. Nearly one-quarter of the global disease burden is due to poor environmental conditions.[2] The relative importance of the environment in causing a disease varies depending on the disease. For example, diarrhea is primarily caused by an unsanitary environment; over 90 percent of all cases can be attributed to environmental factors. Lower respiratory infections, on the other hand, have a variety of causes, with poor air quality being one of the aggravating factors. The environment is estimated to account for only four percent of the cases of these diseases.

A poor environment contributes to many common health conditions in the Philippines. Many causes of diseases and death (Box 1.2) in the Philippines are due in part to environmental factors. Of all the environmental factors that contribute to diseases, air pollution, water pollution, sanitation conditions and hygiene practices are the most important, accounting for an estimated 22 percent of the reported illnesses and six percent of the reported deaths in the country.[3] Diarrhea is the leading environmental health ailment and air pollution contributes to a similar quantity of respiratory and cardiovascular diseases.

Box 1.1 Definition of Environmental Health

Environmental health focuses on those issues where environmental conditions contribute to a health problem that can be reduced through an improved environment. It includes among other things, the health effects of pollution as well as habitats for disease vectors such as dengue and malaria; the effect of stressful work environments on heart disease; the impact of crowded living conditions on tuberculosis; and the effect of lead on violence. Environmental factors that cannot be reasonably improved—such as natural disasters and naturally occurring biological agents such as pollen—are not included.

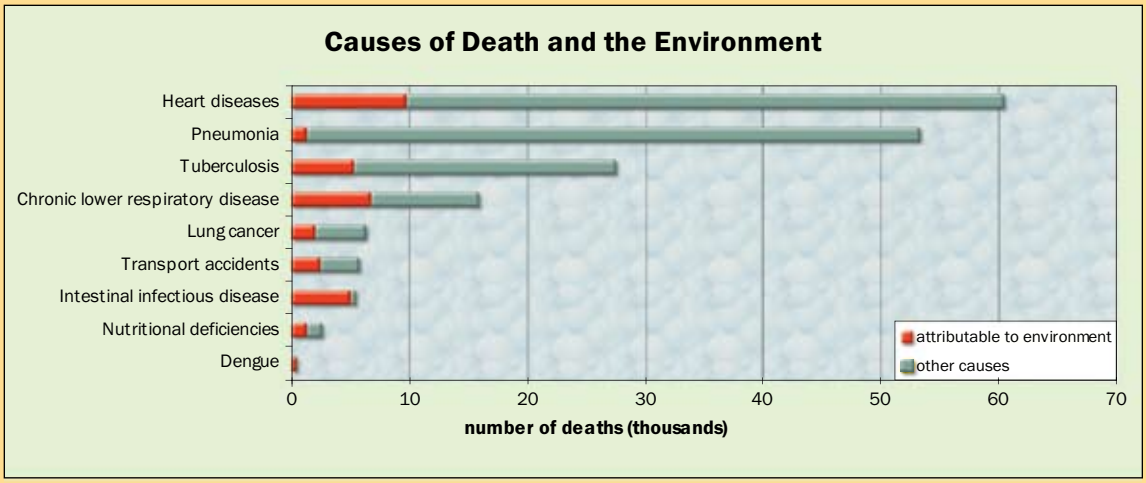
Source: WHO, 2006b.

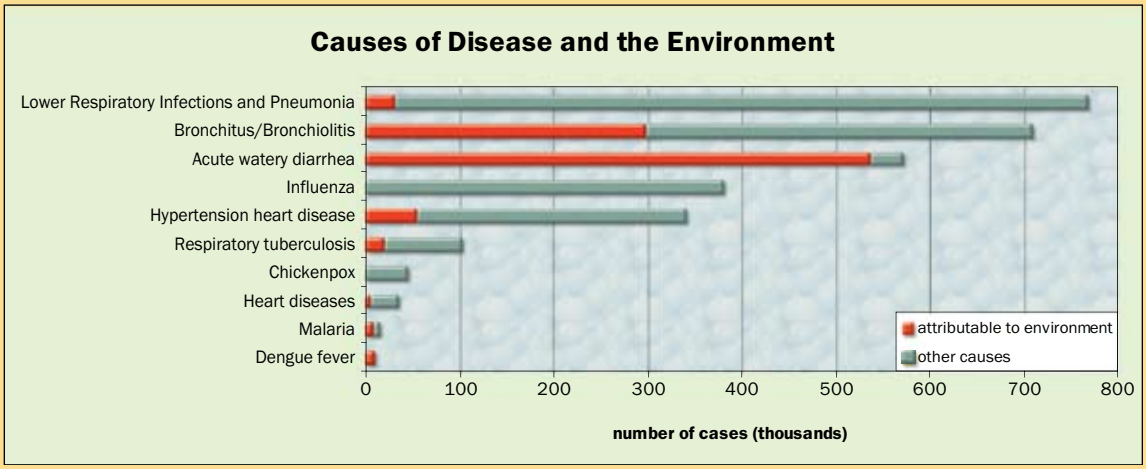
[2] WHO, 2006b.

[3] Based on reported disease incidences and global knowledge of the environmental contribution to these diseases. See Methodology section and Chapters 2 and 3.

Box 1.2 How much does the environment contribute to disease?

The diagrams below show commonly reported causes of disease and death in the Philippines and the extent to which environmental factors contribute to these health impacts. The contribution of the environment is based on information from global scientific literature that has quantified the change in disease as a result of the improvement of a variety of environmental factors, for example, air quality, sanitation, congestion, stress, and vector habitats.





Sources: Mortality data from NSO, 2000b. Morbidity from DOH-NEC, 2004a. The fraction of the cases caused by environmental factors was estimated using the approach described in the methodology section, which is largely derived from WHO 2006b.

The role the environment plays in health involves many diseases and risks. In order to narrow the scope of this document, the *Philippines Environment Monitor* focuses on the environmental factors that contribute most significantly to the health burden in the Philippines. These are air pollution, water pollution, sanitation conditions, and hygiene practices. It should be emphasized that many other environmental health issues are also important and can have impacts nationally, among certain groups or locally. For example, congested urban settings and poor solid waste management are contributing to the growing number of cases of dengue in the country; and urban environments including the availability of pedestrian walkways are contributing to traffic accidents. In addition, exposure to chemicals and hazardous waste presents potential health risks including those associated with persistent organic pollutants, which could have harmful long-term health implications in part due to their ability to accumulate in the human body. While time, space and resources prevent the full treatment of all environmental health issues, we anticipate that the Environment Monitor will provide momentum for ongoing initiatives and a springboard for additional studies on these and other important issues.

Water Pollution and Sanitation-Related Diseases

The majority of the health burden from water pollution, poor sanitation and hygiene is due to contact with human waste, a single gram of which can contain ten million viruses, one million bacteria, and one million parasite cysts.[4] Human fecal matter most commonly enters the body through ingestion via contaminated fingers, food, or water, and secondarily through inhalation or via absorption through cuts and other openings. Once human waste enters the body, the bacteria, parasites, and viruses can grow, causing symptoms such as diarrhea, which is common among bacterial infections, and diseases such as dysentery, cholera, hepatitis A, and typhoid (Table 1.1).

Table 1.1 Environmental risks of water pollution, poor sanitation and hygiene

Major Risks in the Philippines	Health Issues	Symptoms
Ingestion of feces through Contact of mouth to fingers • Lack of sanitation facilities in household • Backed up septic systems, contaminated drainage systems • Lack of adequate water for hygiene purposes Contaminated food • Poor food preparation • Lack of water for hygiene purposes • Fecal contamination spread by insects Contaminated water supply • Inadequately treated or leaky piped water systems • Wells in proximity to human waste disposal areas • Vendors with poor water quality	Diarrhea	Loose, watery stools occurring more than three times in one day, sometimes accompanied by cramping abdominal pain, bloating, and nausea; can lead to dehydration
	Typhoid/Paratyphoid	Fever, chills, sweating, slow heart rate, coughing, skin symptoms, headache; in children, it can induce vomiting and diarrhea
	Cholera	Profuse watery diarrhea, vomiting, leg cramps
	Hepatitis A	Joint aches, abdominal pain, vomiting, loss of appetite, dark urine, fever, enlargement and yellowing of the eyes
Ingestion or contact with soil-contaminated with feces • Unmaintained sanitation systems • Drainage systems • Polluted rivers	Soil-transmitted Helminthes (Trichuriasis, Hookworm or Ascariasis)	*Ascariasis:* Generally asymptomatic unless heavy infestation, which can lead to fever, diarrhea, visceral damage, enlargement of the liver or spleen, toxicity, and pneumonia. *Trichuriasis:* Generally asymptomatic unless heavy infestation, which may cause bloody diarrhea or anemia *Hookworm:* Fatigue, cough, fever, stomach pains, yellowing of skin, feet that go to sleep, head and joint aches, weakness, vomiting, constipation, and diarrhea
Contact with fecal-contaminated water	Schistosomiasis (Areas of Mindanao and the Visayas)	Abdominal pain, cough, diarrhea, high white blood cell count, fever, fatigue, and enlarged liver and spleen
	Skin rashes	Skin color change, blistering, itching, cracking, dryness, swelling, pain
Polluted water that can serve as a breeding ground for *Culex* and *Mansonia* mosquitoes.	Filariasis	Tissue damage resulting in swelling, scarring, and infections and affecting mostly the legs and groin area
Direct contact or injection of toxic chemicals from water pollution through drinking water, eating of shellfish and fish and bathing	Acute poisonings and chronic affects, including birth defects and cancer	Depending on the source, symptoms can include one or more of the following: nausea, abdominal pain, vomiting, diarrhea, fever, headache, or fatigue

[4] Global Water Foundation.

Poor sanitation and exposure to water pollution are common in poor urban communities.
Source: LLDA

The largest risk in the Philippines is among the 25 million people living in households without sanitary toilets.[5] In these households, there is a high risk that human waste would not be safely removed from the household. This risk, combined with hygiene habits—such as washing hands before meals and after use of sanitation facilities—are the major risk factors contributing to diarrheal disease.

Outside the household, the risk of exposure to human waste is on average lower. However, the lack of sewerage systems and operational wastewater treatment facilities throughout the country presents opportunities for direct contact with human waste and indirect contact through fl ies. In every city and many rural areas, water contaminated with human waste can be found in rivers, canals, bays and streets and public walkways with poor drainage. Groups especially at risk are children who play in or near polluted water, and fi shermen and farmers, who are in contact with polluted water as part of their livelihood.

Drinking water from unprotected wells or leaky piped water systems contaminated by sanitation systems is also a risk in many urban areas, where the water systems have high levels of leakage. In rural areas, many unprotected wells located in proximity to human waste have been found to be contaminated.

The quantity of water available to maintain personal hygiene and clean household surfaces in order to prevent ingestion of fecal matter is also an environmental contributor to disease. Thirteen million people lack improved water sources such as protected wells and public taps that can help ensure they have access to an adequate quantity of safe water. Additionally, another 50 million people lack individual water supply connections.

Waste, worms, snails, and insects. Open defecation and improper waste disposal are leaving many water bodies and land contaminated with sewage. In addition to the risk of ingestion of feces, human contact with this waste is one of the main contributing factors to certain diseases that use worms or snails as part of their lifecycle.

Schistosomiasis is transmitted via contact with water that contains a specifi c freshwater snail (*Oncomelania hupensis quadrasi*), which along with the human host acts as a carrier for the parasite. Schistosomiasis incidence is attributed entirely to water pollution, poor sanitation and hygiene because its lifecycle is not only dependent upon the snail and human hosts, but also requires human excreta in the water body and, therefore, is highly dependent on poor household sanitation, and, in many cases, defecation of farm workers and fi sherfolk in water bodies and agricultural fi elds. The disease is commonly found in areas with irrigated agriculture in Eastern Mindanao and the Visayas, where the snail is found.

[5] Twenty eight percent of households in the country do not have sanitary toilets (DOH-NEC 2004a).

A well-designed water supply system improves health by providing good quality water in sufficient quantity.
Source: Water and Sanitation Program, Philippines

Soil-transmitted helminthes (STH) are widespread in the Philippines, affecting many children. They include worm parasites such as ascaris, trichuris, and hookworms that deposit their eggs in soil contaminated with human waste. Humans are infected with STHs when they ingest the eggs through contaminated fingers, food, or water or through direct contact with contaminated soil where the worms can penetrate skin. In addition to the physical symptoms, STHs have been shown to reduce learning, memory, and verbal fluency skills in infected Filipino children.[6]

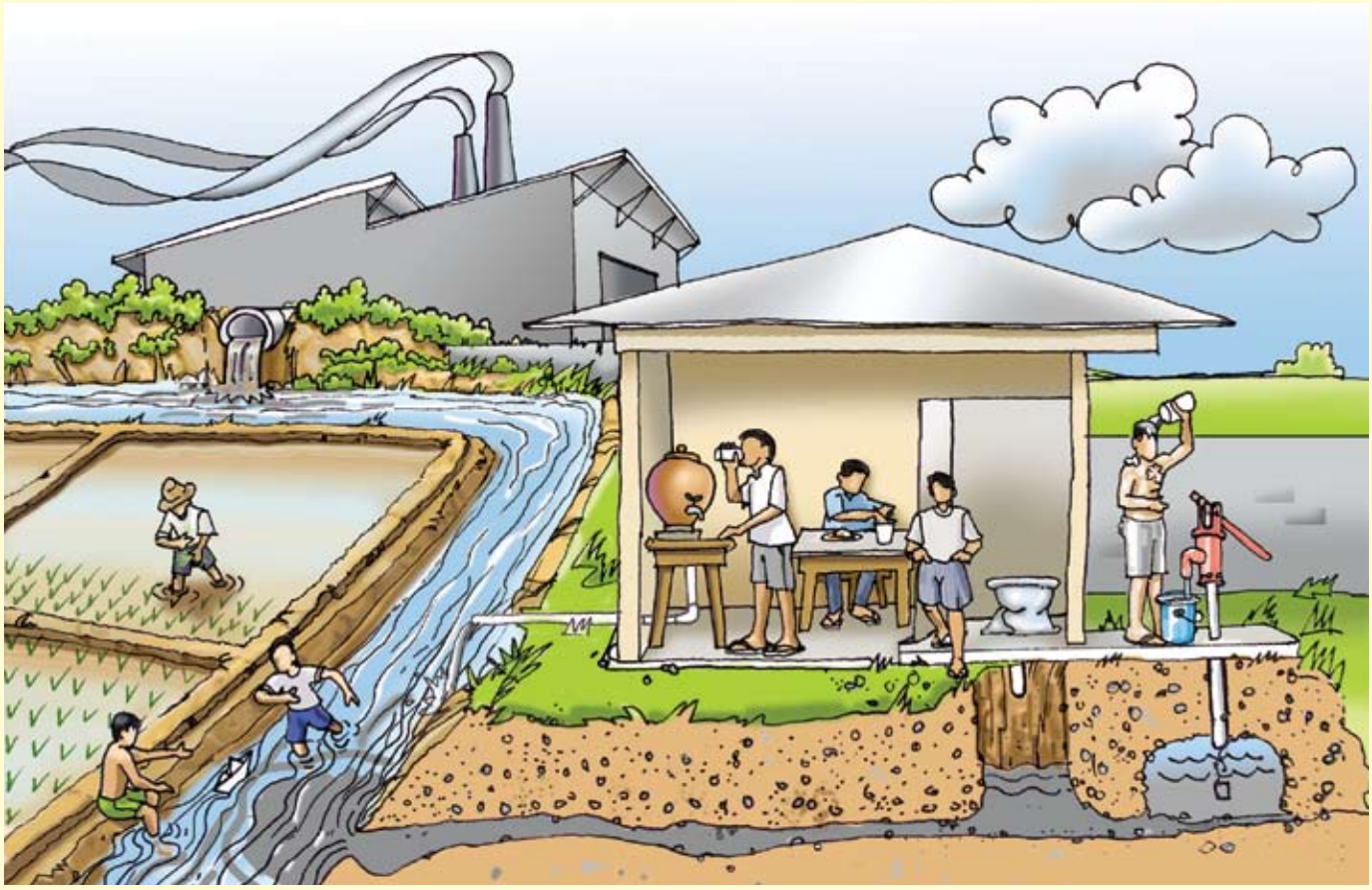
Filariasis is caused by worms that live in a human host and are spread by mosquitoes. The worms eventually reproduce to the point that they cause debilitating enlargement of legs, feet, and other appendages. The highest risk for filariasis is not related to pollution, but rather in areas with plantations of abaca, banana, *gabi*, and other plants with axils. These areas are used as breeding sites for the *Aedes poecilius* mosquito, which is the dominant vector for this disease. Of secondary importance in the Philippines are *Culex* mosquitoes, which breed in very polluted waters, including those associated with poorly maintained, open sanitation systems. *Mansonia* mosquitoes are also vectors for this disease and breed near floating plants such as water hyacinths, which proliferate in many rivers, ponds, and lakes polluted by domestic sewage.

6 Ezeamama *et al.* 2005.

Other health risks of water pollution. Other pollution-related health risks include industrial and agricultural waste and pesticides, which are potential sources of toxic chemicals, including organic pollutants and heavy metals.

Sources of heavy metal pollutants in the country include mercury from mining, and lead and cadmium from industrial sources. Additionally, organic pollutants such as solvents, pesticides, and byproducts of chemical manufacturing are also potential sources of surface water and groundwater contamination. The impacts vary depending on the pollutant and exposure level, but can range from acute effects such as poisonings, to longer term impacts such as cancer.

Paralytic shellfish poisoning is caused by consumption of shellfish contaminated with "saxitoxin," which is present when they are harvested during blooms of marine organisms called dinoflagellates. The toxin causes neurological damage, paralysis, and in some cases death. The blooms—characterized by their reddish-brown color and thus referred to as "red tides"—are also linked to water pollution, since they are in part caused by nutrient pollution from agriculture and domestic waste.

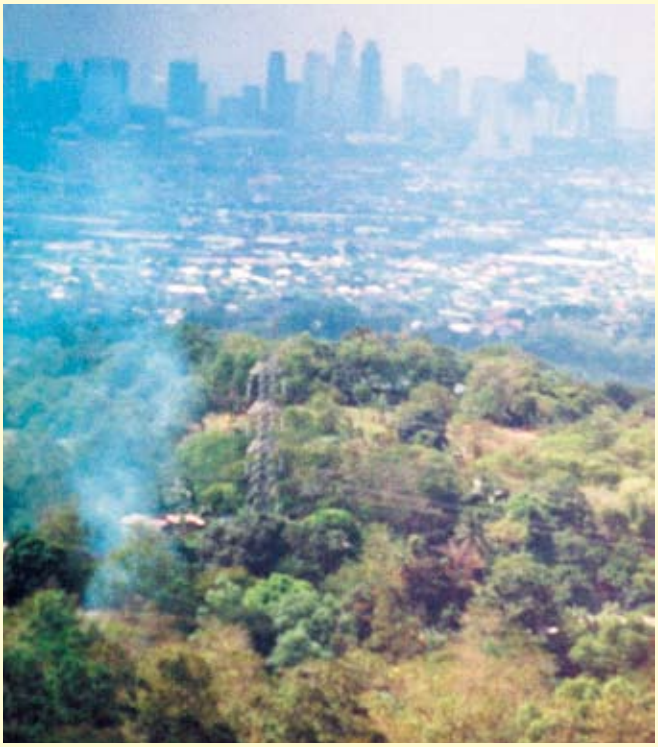


Water-related environment health risks include: exposure to waste through hands, water and food due to poor sanitation and hygiene; and exposure to industrial or human waste in waterways and agriculture.
Source: Authors.

Air Pollution-Related Diseases

Filipinos are exposed to air pollution each day: in urban areas, in agricultural areas after the harvest, and inside homes, where cooking, heating, and smoking can degrade air quality.

The pollutants are a mix of gases, droplets, and particles, the composition of which is dependent on the source. The main pollutants (shown in Table 1.2) include particulate matter, which when found in small sizes (<10 µm or <2.5 µm) can penetrate the lungs deeply; highly reactive compounds such as carbon monoxide and ozone; and other gases that can have a variety of short- and long-term effects depending on the contaminants present and their concentration. Health effects usually result from the combined effect of a mixture of pollutants and oftentimes are due to exposure over many years, even a lifetime.



A view of air pollution in Metro Manila.
Source: Authors.

Table 1.2 Common air pollutants

Pollutant	Sources	Common Health impacts
Particulate Matter measured as TSP, PM_{10}, and $PM_{2.5}$	Particulates are directly emitted through dust and combustion processes, including vehicular exhaust, burning of fossil fuels, and burning of waste, or indirectly from reactions of other pollutants (e.g, SO_2 or NO_2)	Reduced lung function; inflammation of lungs; increased susceptibility to respiratory infections; aggravation of heart and lung diseases; may cause chronic bronchitis and lung cancer
Sulfur Dioxide (SO_2)	Vehicular emissions, combustion of fossil fuel (coal and heavy oils), industrial emissions	Breathing difficulties; eye irritation; chest tightness, especially among asthma sufferers; aggravation of heart and lung diseases
Nitrogen Oxide (NO_2)	Vehicular emissions resulting from high temperature combustion	Irritation of the respiratory tract; increased susceptibility to respiratory infection; impaired lung function
Carbon Monoxide (CO)	Vehicular emissions resulting from incomplete combustion	Headaches; dizziness; chest pains, especially among those suffering from cardiovascular diseases
Volatile Organic Compounds	Vehicular emissions and biomass burning	Irritation of the eyes, nose and throat; headaches, nausea, and loss of coordination; in the long term, some VOCs are suspected to cause cancer and liver damage
Ground-level Ozone (O_3)	Reaction of NO_2 and VOCs in the presence of heat and sunlight	Itchiness and burning of the eyes; irritation and inflammation of the lungs; breathing difficulty; increases susceptibility to respiratory infections
Poly-aromatic hydro-carbons (PAHs)	Combustion processes, including solid fuel use in households; tobacco smoke; vehicular and industrial emissions	Long-term exposure can lead to cancer; affects reproductive system, liver, lungs, and skin

Tables 1.3 Common diseases caused by air pollution	
Diseases	**Symptoms**
Allergic Reactions	Air pollutants can trigger or exacerbate symptoms of existing respiratory conditions such as asthma
Chronic Obstructive Pulmonary Diseases (COPD)	Chronic bronchitis is characterized by persistent cough producing sputum matter that is coughed up from the respiratory tract
Cardiovascular diseases	Chest pain, tightness, heart attack, heart failure, and irregular heartbeat
Physical Damage and Carcinogenesis	Air pollutants can cause physical damage to the lungs, which may develop into a malignant condition, including lung cancer
Pulmonary Fibrosis	Scarring of the lung characterized by the replacement of the air sacs of the lungs with fibrotic tissue reducing the number of alveoli
Acute Respiratory infections (pneumonia, acute bronchitis, and acute respiratory tract infection)	Cough producing greenish or yellow sputum, high fever and shaking chills, chest pain, shortness of breath

Air pollution affects the lungs. Lungs—comprised of exposed membranes designed to continuously transfer large quantities of air into the blood stream—are sensitive to air pollutants. Air pollutants, particularly ozone or volatile organic compounds, are known to injure lung tissue. Air pollution can also increase susceptibility to respiratory infection and causes reduced lung function through narrowing and infl ammation of the airways, abnormal fl uid production, and swelling.

Exposure to air pollution has been shown to aggravate or cause minor lung illnesses (cold, sore throat, runny nose, coughing, and irritation of the eyes), lung infections (acute bronchitis and pneumonia), allergies (asthma), and chronic lung ailments (premature aging of the lungs and chronic obstructive pulmonary disease, or COPD).

…and also the heart. Many air pollutants are able to pass through the lungs into the bloodstream and are eventually transported to the heart and the entire body through blood vessels. Because the cardiovascular system is dependent on the functioning of the respiratory system, it is also indirectly affected by the deleterious effects of air pollution on the lungs. These impacts combined, damage and infl ame blood vessels and affect heart function. They have been shown to cause symptoms such as chest tightness and pain and heart palpitations, as well as increased cardiovascular-related disease incidence and death.

Other health effects of air pollution. Studies also have linked prolonged exposure to particulate matter, sulfur oxides, and polyaromatic hydrocarbons from air pollution to a variety of cancers, including those affecting the heart and lungs. Additionally, there is evidence that absorption of air pollutants into the bloodstream affects other bodily functions, including the nervous system and reproductive functions.[7]

Outdoor air quality is worst in urban areas. Concentrations of particulate matter, which is often used as an indicator of air pollution, are estimated to be three times higher on average in urban roadsides than in rural areas (Table 1.4). Many cities in the country[8] have air pollution levels above national standards.

[7] For further information on the health effects of air pollution, see WHO 2005.
[8] See DENR-EMB 2005a.

The risks of exposure to poor air quality include: air pollution from industries, motor vehicles and waste burning; exposure to smoke from the use of solid fuel for cooking; and environmental tobacco smoke.
Source: Authors.

Air quality indoors is also a risk. Indoor air pollution poses health risks in both urban and rural areas, as people spend a large portion of their time within the confi nes of their homes. In the Philippines, many people use wood as cooking fuel, which (along with other biomass fuels such as charcoal) releases particulate matter, PAHs, and carbon monoxide. Depending on the degree of ventilation, this can lead to increased risk of acute respiratory infections.

Tobacco smoke can also degrade indoor air, depending on the number of smokers in the family and their smoking behavior. Thirty-five percent of Filipinos are smokers.[9]

Table 1.4 Estimated average particulate matter concentrations in urban and rural areas of the Philippines

Area	TSP (µg/m^3)	PM_{10} (µg/m^3)
Metro Manila	175*	65
Other Urban Areas	129*	47
Rural Areas	42	18
DENR standard	90	60

Source: These estimates of PM_{10} concentrations were based on available data and information, including actual roadside PM_{10} measurements, annual roadside mean TSP levels, the predicted levels from the World Bank model, and information about fractions of PM_{10} in TSP.

** Averages of actual roadside measurements*
*** Population-weighted average*

[9] See DOST-FNRI 2003–04.

Burning of agricultural waste contributes to air pollution in rural areas.
Source: R.E.A.P. – Canada.

Other sources can increase exposure in certain localities. In some rural areas, burning of agricultural waste (rice hulls, cane trash, and other residues) and of forest and brushland (as a result of slash and burn, *Kaingin* activities) presents a seasonal air quality issue. Additionally, burning of garbage either at the household level (where there is no collection) or in unmanaged dump sites, presents a local air quality problem.

The following sections of the Monitor provide a more detailed examination of the main health issues related to air pollution, water pollution, sanitation and hygiene in the Philippines. This report applies global knowledge on the relationship of pollution and disease to Philippine circumstances in order to estimate the burden of disease from environmental causes in the country and identify the environmental risks contributing to these diseases. The discussion incorporates disease-specific trends; the likely environmental hazards leading those trends; the key factors that account for people's vulnerability to these hazards; and the economic costs associated with the effects of pollution. The report also highlights the progress made, the policy and institutional barriers to improving health through a better environment, and the main challenges moving forward.

Chapter 2. Water Pollution, Sanitation and Health

NEARLY 6,000 PEOPLE ***die prematurely each year from water pollution and poor sanitation and hygiene.*** Seventeen percent of reported disease cases and one and a half percent of reported deaths in the country each year can be attributed to water pollution, sanitation conditions and hygiene practices. Among them, diarrhea is the third leading cause of disease in the country. Typhoid and schistosomiasis and other diseases also are signifi cant, but together account for less than one percent of all reported disease cases (Tables 2.1 and 2.2).

Filipinos are paying for treatment and losing income. Each year these illnesses cost Filipinos an estimated PHP2.8 billion (US$56 million) in treatment costs, including drugs, hospital fees, and the lost income from missing work to undergo treatment. Premature death from these diseases is also costing the economy an estimated PHP3.9 billion (US$78 million) per year in lost income (Table 2.3).[10]

The disease burden has steadily decreased since the mid-1990s. The incidence of diseases caused by water pollution, sanitation conditions and hygiene practices peaked in the mid-1990s and since that time steadily decreased to less than half of that level (Figure 2.1). This reduction is largely a result of a decrease in reported diarrhea cases and has paralleled a reduction in deaths from infectious disease in the country. Schistosomiasis, hepatitis A, and fi lariasis also are declining.

Table 2.1 Proportion of reported diseases attributable to water pollution, sanitation, and hygiene

Disease	Reported cases attributable to water pollution, sanitation, and hygiene	% of reported cases for all disease
Diarrhea	507,864	16.50
Schistosomiasis	6,628	0.22
Typhoid and paratyphoid	6,300	0.20
Cholera	3,857	0.1
Hepatitis A	2,048	0.07
Filariasis	21	0.0007
Total	**526,718**	**17**

Source: Reported data from DOH-NEC 2004a. Outbreak cases also included for typhoid and cholera (see Table 2.7). Number of cases attributable to water pollution, sanitation, and hygiene were determined as outlined in methodology section.

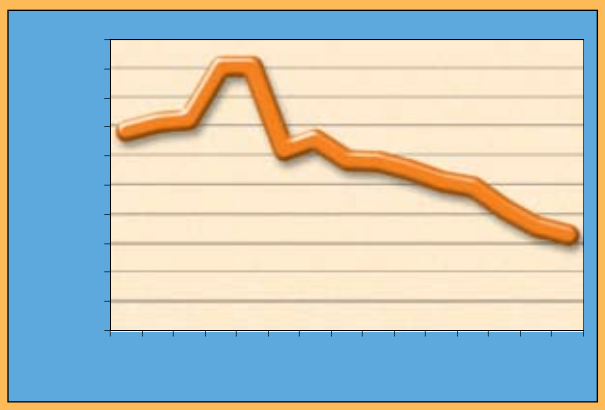
Table 2.2 Reported deaths attributable to water pollution, sanitation and hygiene in 2002

Disease	Number of deaths	% of deaths by all causes
Intestinal and infectious disease	3,811	1.0
Nutritional deficiencies	912	0.2
Hepatitis A	693	0.1
Schistosomiasis	304	0.15
STH	174	0.05
Cholera	70	0.02
Filariasis	2	0.0007
Total	**5,619**	**1.5**

Source: NSO 2000b, 2002. See Methodology section for determination of attributable deaths. Outbreak cases are also included in the above numbers for cholera (Table 2.7).

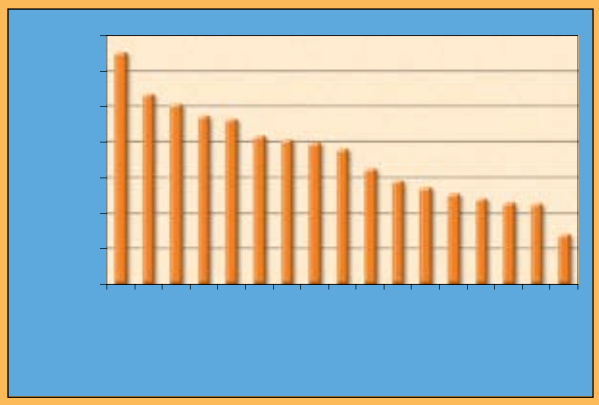
[10] This can be considered a lower bound estimate of economic costs, as it only accounts for the costs associated with cases that are reported to undergo treatment at a clinic or hospital and does not include indirect costs such as pain and suffering associated with having an illness and does not include unreported treatment cases and those for which people do not seek treatment.

Figure 2.1 Reported diseases attributable to water pollution, sanitation and hygiene by year



Source: DOH-NEC 2004a data, including diarrhea, schistosomiasis, viral hepatitis, typhoid and paratyphoid. Comparable data not availabla for dengue, cholera, and filariasis.

Figure 2.2 Reported diseases attributable to water pollution, sanitation and hygiene by region



Source: DOH-NEC 2004a. See Methodology for calculation of attributable diseases. Includes diarrhea, cholera, dengue, filariasis, schistosomiasis, hepatitis A, and typhoid and paratyphoid.

Regional disparities are high. The Autonomous Region of Muslim Mindanao (ARMM), the Central Visayas (Region VII), and Cordillera Administrative Region (CAR) have the highest reported incidence of disease cases attributable to water pollution, sanitation and hygiene. Incidence rates are three to five times higher than regions with the lowest incidence rates (Figure 2.2).

Cases of diarrhea have declined substantially. Since 1995, there has been a steady decline of reported cases of this disease, which is almost entirely caused by water pollution, poor sanitation and hygiene. However, it remains prevalent throughout the country (Figure 2.3).

Schistosomiasis is found only in certain regions. Nationally, reported schistosomiasis incidence has decreased over the last ten years and is considered insignificant in half of the regions. Currently, nearly 90 percent of the reported cases are in CARAGA and the Eastern Visayas (see Map).

Figure 2.3 Diarrhea

Reported Incidence (Per 100,000 per year)

	Cases	Deaths
Overall:	722	3.8
Children (<5 years):	3,872	18
High incidence areas:		
Guimaras Province:	2,660	
Antique Province:	2,332	
National trend over last 10 years:	Reduced 43 percent	
Estimated cases attributable to water pollution, sanitation and hygiene	88 percent	

Includes reported cases only. DOH-NEC 2004a (national incidence); and NSO 2002 (deaths). Trend in incidence based on 1995–2004 data from DOH-NEC, 2004a and DOH, 2000.

STATUS AND TRENDS

INCIDENCE (PER 100,000 PER YEAR)

	CASES	DEATHS
Overall	8,3	0,4
Children (<5 years)	3,5	0

HIGH INCIDENCE AREAS

Agusan del Norte	82
Western Samar	49

NATIONAL TREND OVER LAST 10 YEARS

Incidence reduced 40%

ESTIMATED CASES ATTRIBUTABLE TO WATER POLLUTION, SANITATION AND HYGIENE

100%

Source: National Incidence FHSIS data, 2004 (cases) and PHS, 2002 (deaths). Trend based on FHSIS (2001-2005).

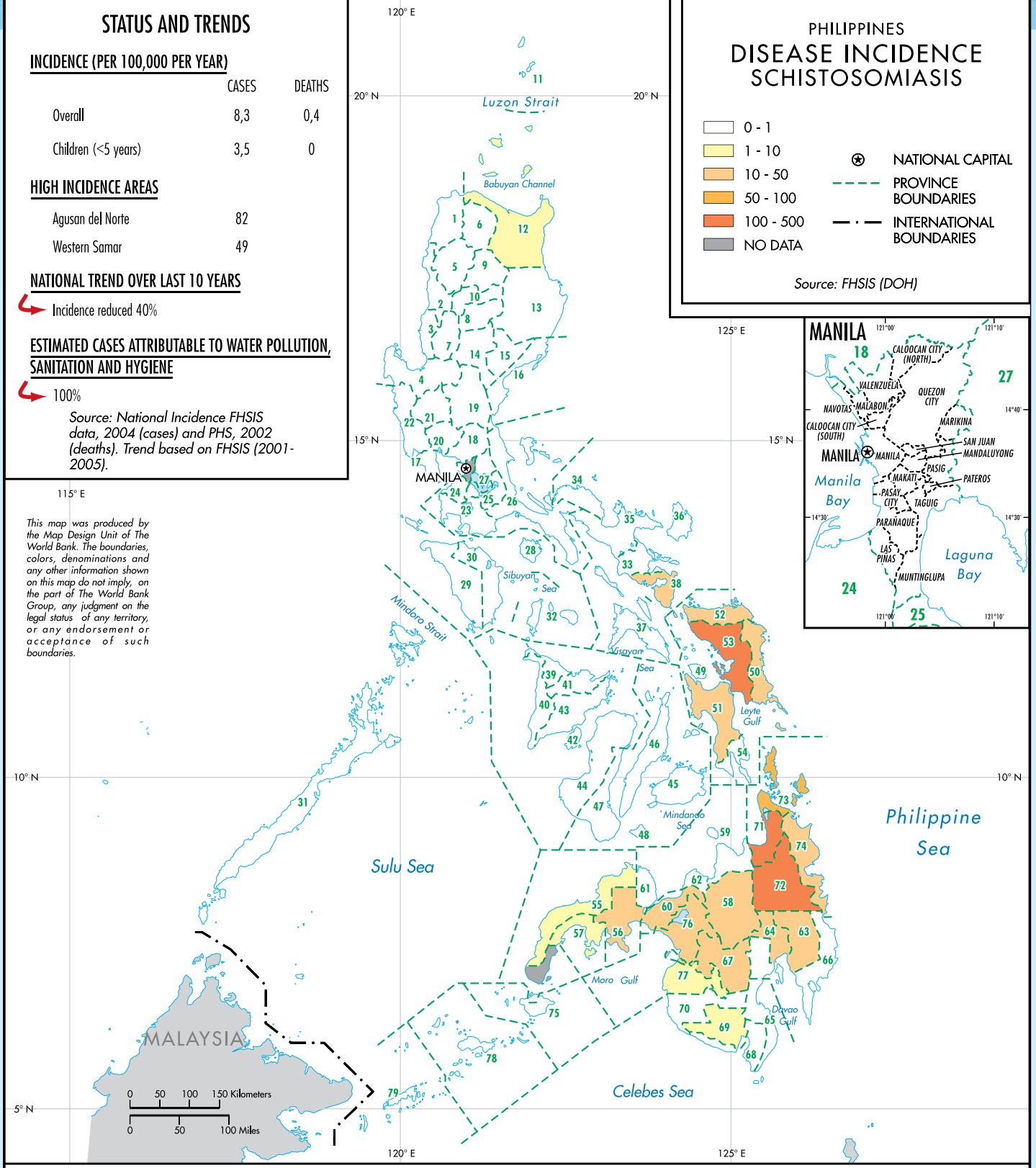
PHILIPPINES

DISEASE INCIDENCE SCHISTOSOMIASIS

0 - 1
1 - 10
10 - 50
50 - 100
100 - 500
NO DATA

NATIONAL CAPITAL
PROVINCE BOUNDARIES
INTERNATIONAL BOUNDARIES

Source: FHSIS (DOH)



This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

PROVINCES:

1. Ilocos Norte
2. Ilocos Sur
3. La Union
4. Pangasinan
5. Abraa
6. Apayao
7. Benguet
8. Ifugao
9. Kalinga
10. Mountain Province
11. Batanes
12. Cagayan
13. Isabela
14. Nueva Vizcaya
15. Quirino
16. Aurora
17. Bataan
18. Bulacan
19. Nueva Ecija
20. Pampanga
21. Tarlac
22. Zambales
23. Batangas
24. Cavite
25. Laguna
26. Quezon
27. Rizal
28. Marinduque
29. Mindoro Occidental
30. Mindoro Oriental
31. Palawan
32. Romblon
33. Albay
34. Camarines Norte
35. Camarines Sur
36. Catanduanes
37. Masbate
38. Sorsogon
39. Aklan
40. Antique
41. Capiz
42. Guimaras
43. Iloilo
44. Negros Occidental
45. Bohol
46. Cebu
47. Negros Oriental
48. Siquijor
49. Biliran
50. Eastern Samar
51. Leyte
52. Northern Samar
53. Samar
54. Southern Leyte
55. Zamboanga del Norte
56. Zamboanga del Sur
57. Zamboanga Sibugay
58. Bukidnon
59. Camiguin
60. Lanao del Norte
61. Misamis Occidental
62. Misamis Oriental
63. Compostela Valley
64. Davao del Norte
65. Davao del Sur
66. Davao Oriental
67. South Cotabato
68. Sarangani
69. North Cotabato
70. Sultan Kudarat
71. Agusan del Norte
72. Agusan del Sur
73. Surigao del Norte
74. Surigao del Sur
75. Basilan
76. Lanao del Sur
77. Maguindanao
78. Sulu
79. Tawi-Tawi

APRIL 2007 IBRD 35224

Table 2.3 Treatment costs and lost income from diseases attributable to water pollution, sanitation and hygiene

Water-related Disease	Morbidity		Mortality	Total (PHP million/yr)
	Direct income losses due to hospitalization (PHP million/yr)	Medical Expenses and Hospitalization (PHP million/yr)	Income losses to GDP due to lost productive life years (PHP million/yr)	
Diarrhea	139	2,522	2,827	5,488
Nutritional deficiencies	NA	NA	676	676
Cholera	1.3	28	14	43
Typhoid	2.5	51	NA	54
Hepatitis A	2,048	17	0.07	222
Schistosomiasis	3.1	50	162	215
Filariasis	0.02	0.3	1	1.3
Total	**PHP147 million/yr (US$2.9 million/yr)**	**PHP2,668 million/yr (US$53 million/yr)**	**PHP3,884 million/yr (US$78 million/yr)**	**PHP6,700 million/yr (US$134 million/yr)**

Source: See methodology section for details.

Figure 2.4 Hepatitis A

Reported Incidence (Per 100,000 per year)

	Cases
Overall:	5.1
Children (<5 years):	3.8
High incidence areas:	
Guimaras Province:	82
Antique Province:	49
National trend over last 10 years:	Reduced 70 percent
Estimated cases attributable to water pollution, sanitation and hygiene	50 percent

Includes reported cases only. DOH-NEC 2004a (national incidence); and NSO 2002 (deaths). Trend in incidence based on 1994–2004 data from DOH-NEC, 2004a.

Medical expenses is one of the costs families are paying due to water pollution, poor sanitation and hygiene.
Source: Association of Medical Doctors of Asia (AMDA International)

Hepatitis A has declined 70 percent over the last ten years. Water pollution, sanitation and hygiene are estimated to account for 50 percent of the reported cases of this disease. It is found throughout the country, with relatively little variation among regions (Figure 2.4).

Filariasis is limited to a few regions. The reported incidence of filariasis in 2005 was 0.5 cases per 100,000 Filipinos. This is similar to a decade ago, but lower than in 2001 and 2002, when incidence rose to 2.5 cases per 100,000. Ninety percent of the reported cases are limited to three regions—CARAGA, Western Mindanao, and the Eastern Visayas. The highest rates are found in Surigao del Sur (74 cases per 100,000 per year) and Agusan del Norte (38 cases per 100,000 per year).[11] It is estimated that a relatively small portion of the cases of this disease are due to water pollution, poor sanitation and hygiene.

[11] DOH-NEC 2004a.

Cholera is an outbreak threat. While overall reported cholera incidence is low relative to other diseases (0.4 cases per 100,000 each year), it occurs in outbreaks and thus, can have high incidence in localized areas, typically in urban slums, where water supply and sanitation systems are inadequate. NCR (Pasay and Quezon City) and Western Mindanao (Zamboanga City) are the only areas that consistently report cholera cases. The largest recent outbreak was in Pangasinan in 2004, which resulted in 3,424 cases. The number of outbreaks per year has decreased by half over the last 10 years.

Reported cases of typhoid remain high. An estimated 50 percent of typhoid cases are due to water pollution, sanitation conditions and hygiene practices. Outbreaks are commonly associated with contaminated water supply systems. Reported cases of typhoid and paratyphoid have not declined over the last ten years and are found in all regions; seven consistently report it as one of the top ten leading causes of disease (Figure 2.5). The number of outbreaks per year, however, has reduced since the 1990s.

At least 40 percent of schoolchildren have soil-transmitted helminthes. Studies have consistently indicated a very high prevalence of these diseases among Filipino children. An average of between 40 and 95 percent of the children studied were found to be infected with at least one of these parasites, and between 4 and 22 percent were heavily infected.[12] Studies undertaken ten years ago show similarly high prevalence rates.

Paralytic shellfi sh poisonings have declined During the 1980s and early 1990s there were many outbreaks of paralytic shellfi sh poisoning resulting in as many as 200 to 300 reported cases per year. In 2005, there were no reported cases in the Philippines, while in 2004 there were only four cases. In 2004, disease cases were due to red tides in Negros Occidental and Masbate.[13]

Figure 2.5 Typhoid and Paratyphoid Trends

Incidence (Per 100,000 per year)

	Cases	Deaths
Overall:	16	1.1
Children (<5 years):	18	0.3
High incidence areas:		
Ifugao Province:	271	
Quirino Province:	457	

National trend over last 10 years: No Trend

Estimated cases attributable to water pollution, sanitation and hygiene 50 percent

Includes reported cases only. DOH-NEC 2004a (national incidence); and NSO 2002 (deaths). Trend in incidence based on 2001–2005 data from DOH-NEC, 2004a.

Soil transmitted helminthes are found in over 40 percent of Filipino children and are spread through soil contaminated by fecal matter.
Source: LLDA.

[12] Kim, B. *et al.* 2003 survey of 301 children in Roxas City; and Balazario *et al.* 2000 survey of 1, 871 children in Luzon, Visayas, and Mindanao; Surveys done in 1995 (UNHP) and 1998 (CDCS) indicated a 57 and 64 percent prevalence, respectively.
[13] BFAR website and DOH-NEC 2004a.

The Risks of Poor Sanitation and Water Pollution

Basic household sanitation, including sanitary toilets and septic tanks, combined with hygiene practices such as washing hands, provides a means of removing human waste safely away from the household and has been shown worldwide to substantially reduce incidence of disease.

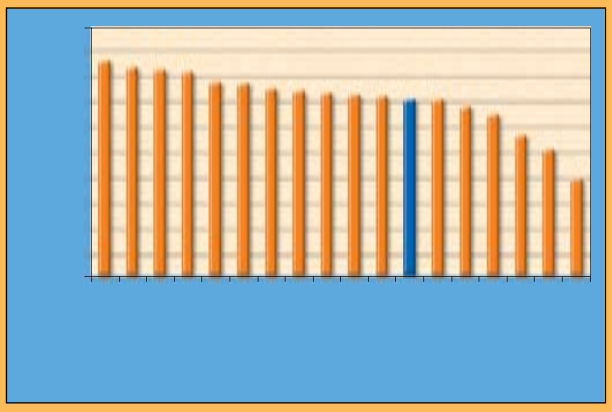
There have been large improvements in basic household sanitation. Construction of sanitary toilets has increased the proportion of the population with access to basic sanitation in the country from 57 percent in 1990 to 72 percent in 2004 (Table 2.4). The 15 percent improvement is comparable to other Asian countries. The gap in access to basic sanitation facilities in rural and urban households, however, remains high. Only 59 percent of rural households have access to basic sanitation, well behind urban households with 80 percent (Table 2.4). In many rural areas, open defecation is common as a means of waste disposal among groups such as farmers, fi shermen, and children. Several regions are signifi cantly behind the 72 percent national average, notably the Autonomous Region of Muslim Mindanao (ARMM) (Figure 2.6).

Table 2.4 Percent of households with access to improved sanitation

	1990	2004
Urban	66	80
Rural	48	59
Total	**57**	**72**

Source: UNICEF 2006.

Figure 2.6 Percent of households with sanitary toilets by region



Source: Department of Health National Epidemiology Center 2004a.

Hand washing is among the most effective ways of reducing disease. Studies worldwide have shown that programs to encourage the habit of washing of hands with soap can reduce diarrhea by between 30 and 50 percent. Recent evidence has indicated that pneumonia can be reduced by similar levels.[14] In the Philippines, surveys have shown that nearly all Filipinos regularly wash their hands before eating. However, only 26 percent of households regularly wash their hands before handling and preparing food, and less than 50 percent regularly wash their hands after going to the toilet (Table 2.5).[15]

Table 2.5 Hand washing habits

Timing of hand washing	% of households
Before handling and preparing food	25.7
Before eating	96.9
After going to toilet	45.1

Source: DOH 2000.

[14] Esrey *et al.* 1991; Hutley *et al.* 1997; Luby *et al.* 2005.
[15] Data from DOH 2000 also See ISF 2004.

Box 2.1 Examples of sanitation conditions in poor communities in the Philippines

Barangay Tangnan, Panglao, Bohol. This is a coastal community on the northern side of Panglao with a total population of 2,957. Eighty-two percent of the community uses pour flush pit latrine systems, largely without septic tanks. Waste is leaking into the porous ground (limestone) and into the groundwater. Defecation behind bushes or in fields is common. The water supply is contaminated with bacteria (E. coli).

Barangay Looc, Dumaguete City: This community is located near the pier in Dumaguete City and is composed primarily of informal settlers. Most residents have simple houses made of boards, cement floors, and iron sheets that do not contain sanitary toilets. Sixty-three percent of the households surveyed send their sewage to the barangay canal, which emits foul odors, while the remainder goes into the groundwater (30 percent) or the nearby creek (6 percent). Flooding is common at times of heavy rainfall, in part due to clogged drainage systems. Groundwater used by some residents for drinking water was recently declared unfit to drink.

Communities near waterways in Metro Manila. Low income areas are found throughout Metro Manila. Many of these communities are located near waterways such as the Pinagsama Creek (Taguig) and Manggahan floodway. Most houses have flush toilets and individual septic tanks that are not maintained, in part due to their inaccessibility. Some children defecate outdoors. The waste from septic tanks and other liquid waste (kitchen, laundry) is deposited in an open area or drained from the house to open concrete, earthen drains, and some covered concrete drains. These drains are often in disrepair or get clogged, necessitating periodic maintenance. It is estimated that with improved drainage and septic tank management systems, these areas could have health benefits of PHP30 million per year (PHP300 per person per year).

Source: World Bank 2003b; WSP.2006.

Campaign advertisement encouraging regular maintenance of septic tanks.
Source: USAID Philippines and Municipality of Iloilo

Septic tanks are commonly used. Motivated by requirements under the National Building Code, half of Filipino households overall and most urban dwellers have septic tanks that collect wastewater from their households.[16] Septic tanks are designed to treat waste through the removal of solids and assist in disinfection. The tanks generally receive only toilet wastes while wastewater from other household activities is discharged directly to the surface drainage system.

[16] NSO 2000b.

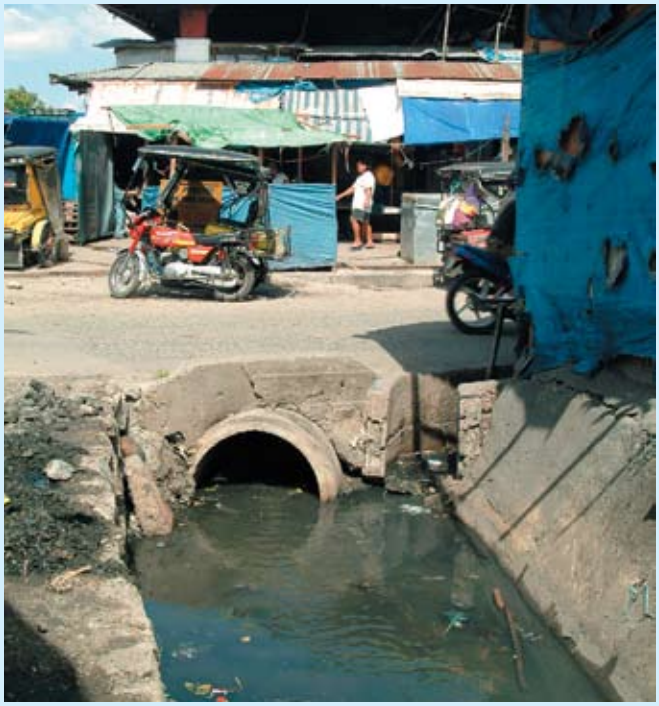
Poor construction and maintenance of septic tanks reduces their effectiveness. Many septic tanks are poorly or improperly constructed without lining and underground filters. Moreover, to function as designed, septic tanks need to be maintained regularly in order to remove built-up solids. Nationally, less than one percent of tanks are known to undergo regular desludging with acceptable treatment.[17] In most cases, they are only maintained in response to emergency situations when the septage backs up into the household or the tank is otherwise clogged. When they are desludged, the waste sludge is not disposed according to DENR standards, except in portions of Manila, Baguio, and a few cities in Palawan that have public treatment facilities.

Drainage systems and groundwater receive much of the waste in urban areas. Only seven cities have piped sewer systems. These systems cover a small percentage (between one and 15 percent) of their respective populations. As a result, 95 percent of the wastewater flowing from households directly or via septic tanks is transported into groundwater or into public canals and drainage systems and eventually into rivers and other water bodies.[18] For example, in Metro Manila, only 15 percent of the population is connected to the sewerage system. As a result, 192,000 tons of domestic waste enters the drainage system and groundwater each year after only minor treatment in largely unmaintained septic tanks. This has left urban drainage systems and groundwater contaminated with human waste. It poses a risk for the portion of the urban population proximate to open drainage systems. It is also a risk to those that rely on groundwater wells and leaky water distribution systems for their water supply (Table 2.6).

Table 2.6 Bacteria concentration in drainage systems in Manila

Community	Type of drainage	E-Coli (million/ 100mL)
Taguig	Open drains and covered concrete draining to creek	0.2–0.9
Manggahan Floodway	Shallow lined channels draining to creek or larger roadside channels	0.2–0.9
Sitio Olandes	Shallow concrete channels in streets with drainage to deeper channels	0.2–5
Camp Atienza and Industrial Valley	Covered concrete channels along street draining to open channel/creek	0.2–23

Source: World Bank 2003b.



An open drain in Metro Manila.
Source: LLDA

[17] The exact quantity is not known as the disposal practices of private septic tank maintenance companies are not regulated or monitored. Of the regulated systems, there are only three known cities with public facilities for maintenance and treatment of septage waste, which together serve 0.3 percent of the country's population. There are plans to expand treatment of septage in Manila (see Management Response section).

[18] A total of 2 million people in urban areas (4.7% of the urban population) are connected to sewerage systems (Manila, 15%; Baguio City, 2%; Zamboanga City, 1%; Vigan City, 3%; Bacolod City, <1%; Cauayan, Isabela, 2%; Davao City, <1%).

Much of the surface water in urban areas is a public health risk. Monitoring of surface water indicates that most of the larger urban centers in the country have rivers that pose a contact risk to public health (below a Class C standard) (Table 2.7). Levels of coliform bacteria in all rivers in Manila, including tributaries of Laguna de Bay, exceed DENR standards in some cases by several orders of magnitude. Many beaches in Manila Bay, especially those along the eastern side, also have levels of bacteria that present a signifi cant health risk to those using it for transport, fi shing, and bathing.[19]

Table 2.7 Urban or peri-urban areas with rivers (Class C or below) that pose contact risk to public health

City	River(s)
Metro Manila	Parañaque River; San Juan River; NMTT River; Marikina River; Pasig River
North Manila Bay Area San Jose del Monte; Marilao; Sta. Maria; Apalit; Calumpit; Meycauayan; Guiginto	Marilao River; Sta Maria River; Pampanga River; Meycauayan River; Guiguinto River
West Bay of Laguna de Bay	San Pedro; Cabuyao; San Cristobal; Santa Cruz
Dagupan City, Pangasinan	Dagupan River
San Fernando City, Pampanga	San Fernando River
Calapan City, Mindoro Oriental	Calapan River
Cebu City	Guadalupe River; Cotcot River
Iloilo City	Jaro River; Iloilo River
Zamboanga City	Saaz River; Manicahan River
Butuan, Agusan del Norte	Agusan River

Source: DENR-EMB 2003.

[19] It is estimated that between 1995 and 1998 water-related disease and red tides cost the population near Manila Bay a total of PHP327 million (US$7.3 million) per year in lost income and health expenditures. See GEF/UNDP/IMO 2004.

Waterways polluted with sewerage are common in urban areas in the Philippines.
Source: Authors.

Rural surface water can also spread disease. Contaminated surface water from open defecation and sewage in rural areas are also an important risk. It has been shown that contact with contaminated water in rural areas can lead to the spread of schistosomiasis and other diseases (Box 2.2).

Box 2.2. Schistosomiasis in Gonzaga, Cagayan Province

Barangay Tapel is a rural barangay, where the main sources of livelihood are farming and fishing. Most of the farming areas are irrigated by community-constructed irrigation canals. A study in 2004 found that 6.3 percent of the population—most of whom were farmers—tested positive for schistosomiasis. The disease was found to be transmitted via the Nagbabaguian Creek. The creek, which is near the farmers' fields and commonly floods them, is inhabited by 92,000 vector snails and is visibly contaminated with human waste. As nearly 90 percent of the barangays have sanitary toilets with septic tanks and open defecation by farmers is common, the disease is likely spread through water contaminated by farmers who defecate openly in their fields or in the creek and then wade in the water without protective boots, allowing for transmission of the disease through the skin.

Source: DOH-NEC 2004b.

Farmers in schistosomiasis endemic areas such as CARAGA risk acquiring the disease when in contact with contaminated water. *Source*: World Bank Photo Library.

Red tides are common in Philippines. Between 1983 and 2002, there were 42 major red tides with toxic algal booms that cause paralytic shellfi sh poisoning. These occur in coastal areas in many parts of the country and were very common in the Visayas in the 1980s and 1990s. The most common areas for red tides more recently have been on the coast of Zamboanga del Sur and in Manila Bay. The impact of the occurrence of red tide on health has declined signifi cantly due to government monitoring and regulation of the consumption of shellfi sh in affected areas.[20]

Heavy metal contamination from mining activities is a commonly reported source of toxic water pollution. In 1996 the Marcopper mine released an estimated 1.5 million m^3 of mine tailings containing heavy metals which contaminated drinking water, agricultural fi elds, the Boac River, and nearby villages, causing elevated levels of heavy metals in some of the residents of the area. In addition to this case, several other mining operations have exposed populations to heavy metals. These include:

- a mercury mine near Honda Bay that contaminated surface water with mercury, leading to the accumulation of the metal in fi sh and in people in the area;
- gold mining activities in Sibutad Western Mindanao that contaminated surface water, leading to elevated levels of mercury in the exposed population;
- gold mining activities in Monkayo Mindanao that contaminated the Naboc River with mercury, which accumulated in fi sh and in rice cultivated in the area and led to high levels of mercury in a portion of the population; and
- gold processing activities in Apolon, Tagum, Davao Del Norte that caused elevated levels of mercury in water and a portion of the fi sh and children in the area.

Studies in the Philippines have found that people with elevated levels of mercury can have higher incidence of some health problems such as gingivitis, skin discoloration, neurological disorders, and anemia.[21]

Other toxic pollution incidences have also been reported. For example, an electronics company reported to DENR (March 2007) that groundwater in Las Piñas in the vicinity of a site previously used by the company was contaminated by trichloroethylene. Trichloroethylene and the chemicals it forms after decomposition can lead to short-term symptoms such as dizziness and headaches and longer term effects such as cancer. The municipality, the company, DENR, DOH, and Maynilad Water Company are working to better understand the extent of the contamination and provide those people using the groundwater with alternative sources of water supply.

[20] BFAR website and NEC-DOH 2004a.

[21] Akagi *et al.* 2000 (Apokon case); Maramba *et al.* 2006 (Honda Bay case); Castillo *et al.* 2003; Cortes-Maramba *et al.* 2006 (Sibutad case); Tauli Corpez http://www.twnside.org.sg/title/toxic-ch.htm (Marcopper case); Appleton *et al.* 2006 (Moncayo case).

The Risks of Inadequate Water Supply

Both the quantity and quality of water supplied to households are important factors that can increase exposure to water pollution and waste. The source of the water and the distribution system can create opportunities for water supplies to be contaminated in poorly designed wells, leaky public distribution systems, or through transport from trucks and water vendors. Having an adequate quantity of water to undertake hygienic practices (including hand washing and bathing) and for household cleaning of sanitation facilities and food preparation areas is also an important factor in reducing disease transmission.

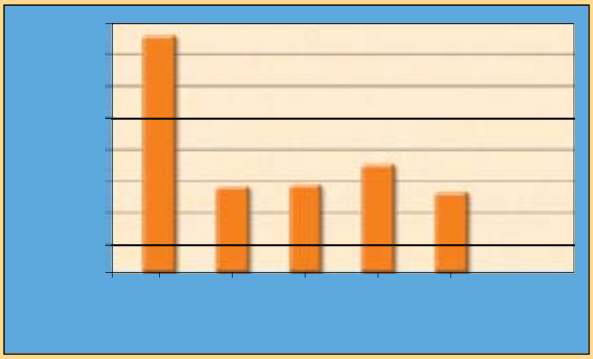
A house water supply connection in Manila.
Source: Authors.

Gains made in household connections have increased the amount of water available for hygiene. Between 1993 and 2003, the use of traditional water sources such as wells, ponds, rivers, and springs for drinking water decreased from 62 to 40 percent, while piped household connections increased from 26 to 40 percent over the same time period. As a result, an estimated 58 percent of the population in urban areas and 23 percent in rural areas have water supplied through house connections.[22]

The larger quantity of house connections has increased the water available for hygiene purposes. Surveys have found that people with house connections use 150 liters of water per day, which is two to three times higher than those using other sources. It is estimated that optimal health benefi ts can be achieved using 100 liters of water per day combined with good hand washing habits (Figure 2.7).

People are increasingly reliant on water vendors. While household connections have expanded nationally, they have not been able to keep up with population growth, resulting in an increased use of water peddlers, trucks, bottled water, or water refi lling stations. Twelve percent of the population in urban areas is dependent on these alternative sources of water.[23]

Figure 2.7 Water use by level of service



Level I: Point sources, including shallow wells, deep hand pumps, and spring development.
Level II: Communal faucets and public taps.
Level III: Individual household connections.

Source: SWS and World Bank, 2000. A similar, more recent survey in Metro Manila found similar results, MWSS/MWSI, unpublished data, 2007.

[22] Taken from data and trends presented in WHO/UNICEF 2006.
[23] NSO 2003b.

A water vendor in Manila.
Source: Water and Sanitation Program.

Regular monitoring of water refi lling stations and bottled water has been strengthened signifi cantly through the DOH and local sanitary inspectors, which helps better ensure the quality of the water from these sources. Informal, unregistered peddlers, however, are in many cases not regulated or monitored actively. The quality of the water and handling practices and their associated health risks are therefore largely unknown. The high cost and time necessary to obtain water from water vendors can also reduce water use and diminish the associated hygiene benefi ts in many cases. In part due to these concerns, they are not recognized as improved water sources for purposes of meeting the country's Millennium Development Goal for water supply. With this growing dependence on these sources, the Philippines is now off track to meet this goal.[24]

Unsafe water quality is common. Studies of groundwater quality found that 58 percent of the sampled groundwater tested positive for coliform bacteria. Surveys of LGUs have also indicated that one half or more of their public water systems do not meet drinking water quality standards.[25] In addition to contributing to endemic levels of disease from daily consumption and exposure, contaminated water supplies have resulted in outbreaks causing 5,000 cases of diarrhea, typhoid, and cholera over the past three years (Table 2.7). The reasons for the contamination can largely be traced to a combination of an inadequate sanitation system and a water supply system that is susceptible to contamination (Box 2.4 and 2.5.

Table 2.7 Recent diseases outbreaks caused by contaminated water supplies

City	Diseases (# of cases)	Deaths
Ibajay, Aklan (2006)	Typhoid (82)	–
Sibulan , Negros Oriental (2005)	Typhoid (82)	–
San Andres and Virac , Catanduanes (2005)	Cholera (444)	14
Virac, Catanduanes (2004)	Diarrhea (675)	–
Tondo, NCR (2003)	Diarrhea (385) Cholera (41)	8
45 locations, Pangasinan (2004)	Cholera (3,424)	47
Muntinlupa, NCR (2004)	Cholera (82)	–
Marabut, Samar (2004)	Typhoid (32)	3
Source: NEC.		

[24] The joint monitoring program for the MDGs has reported that access to improved water sources declined from 87 to 85 percent between 1990 and 2004. UNICEF 2006. In urban areas, access to improved water sources decreased from 95 to 87 percent.

[25] Compiled from feasibility studies under the World Bank LGU Water and Sanitation Project.

Wells such as these can be contaminated if located close to an unprotected sanitation facility.
Source: World Bank Photo Library

The quality of water supply depends on the distribution system.
Source: Authors.

Box 2.3 DENR's Tapwatch Program

In 2005, DENR monitored 88 shallow wells used for water supply in targeted areas. Overall, 21 sites were found to be potable, 27 failed to meet drinking water standards for fecal coliform, and the remainder needed further testing to determine potability. The suspected sources of contamination were defective septic tanks, untreated wastewater, and animal wastes.

Location	Proportion of Wells Below Standard
Cagayan, Nueva Vizcaya	6 out of 10
Pampanga	3 out of 3
Oriental Mindoro	3 out of 8
Iloilo City	6 out of 8
Cebu City	2 out of 6
Leyte	1 out of 6
Zamboanga City	3 out of 8
Davao City	1 out of 4

Source: DENR-EMB 2005b.

Box 2.4 Cholera outbreak in Caloocan City Jail

During August and September 2001, 15 percent of the 1,245 inmates in the Caloocan Jail had diarrhea, resulting in one death. Tests confirmed cholera to be the cause. After investigation by the DOH, it was determined that it was due to a contaminated water supply. Water supply pipes tied together using rubber bands were submerged in stagnant water where human feces were found to be coming from the septic tank pipes, which were damaged and leaking. A shallow well being used by some of the inmates for washing kitchen utensils and bathing was also found to have a pipe from the septic tank lying in it. The Caloocan LGU, Bureau of Jail Management, Maynilad Water and DOH responded to the findings by treating the inmates, repairing the distribution pipes, improving hygiene, and improving the septic tank system.

Source: DOH-NEC 2001.

Box 2.5 What are the risks to your water supply?

Individual well systems. The depth and location of a well are risk factors for well-water systems. Shallow wells draw from groundwater nearest to the land surface, which is the most likely to be affected by contamination sources. Deeper wells extract groundwater from areas that benefit from further filtration through soil and from sources less likely to be affected by surface activities.

Countermeasures. Locate the well away from and on higher ground than sanitation facilities, sewers, fuel tanks, livestock activities, and solid waste disposal sites; dig deep wells where possible; prevent channeling of surface water into well systems using a casing around the well borehole and a well cap; and regularly test the water quality.

Piped water supply. Risks to piped water systems relate to the adequacy of treatment and the integrity of the distribution system. Typically water service providers treat the water using sediment removal and disinfection and other treatment depending on the quality of the source water. In cases where the treatment system is adequate, the risk is associated with a malfunctioning water system, especially in cases of flooding or power failure. Low water pressure due to aging or unmaintained pipelines also provides an opportunity for sewage to flow into the water supply system or for backflow of contaminated water from users with direct connection to a contaminated pipe or vessel, such as illegal connections or industrial processes. Stores of bacteria and other material in sediment deposits in low water pressure networks or biofilm formation on pipes can also be resuspended in cases of rapid changes in flow.

Countermeasures. Operation, testing, and public information on treatment system performance; providing residual chlorine to disinfect leakages and control biofilms; reducing the length of time in distribution systems and pressure surges; providing devices (stop valves or air gaps) that prevent backflow into the water system; providing regular maintenance and rehabilitation of network leaks; and locating new network systems away from septic tanks and sewers.

Water vendors. Registered water refilling stations and bottled water are regularly monitored by the Department of Health. However, there is limited knowledge and transparency about the source, treatment, and water quality from informal water vendors. The major risks depend on the source of water and share similar risks as piped water and wells. For example, shallow wells in urban areas would be considered high-risk sources, while illegal connections or reselling of utility water would share similar risks associated with piped water supply. During transport, delivery, and storage, there are risks associated with the contamination of public faucets, tanks, or other vessels.

Countermeasures. Better knowledge of the source, treatment process, and quality; similar measures to ensure quality of source water as above; and disinfection and covering water transport and storage containers.

Chapter 3. Air Pollution and Health

AIR POLLUTION ADDS *to the large health burden of cardiovascular and respiratory disease.* These diseases are consistently among the leading causes of disease and death in the Philippines. There has been no signifi cant reduction in their overall incidence over the past five years. In 2004, air pollution-related cases of these diseases amounted to an estimated fi ve percent of all reported diseases in the country. Air pollution is also estimated to account for over four percent of all deaths in the country (Tables 3.1 and 3.2).

The costs are high. The costs associated with treating the reported disease cases attributed to air pollution amount to PHP962 million (US$19 million) per year (Table 3.3). Similarly air pollution-related deaths due to pneumonia in children, and cardiopulmonary disease and lung cancer in adults, resulted in an additional PHP6.7 billion (US$134 million) in lost income per year.[26]

Metro Manila is estimated to have the largest disease burden from outdoor air pollution. Estimates based on the correlations of particulate matter concentration in outdoor air and mortality, indicate that there are nearly 5,000 premature deaths each year in Manila due to respiratory and cardiovascular diseases from exposure to poor air quality. This amounts to 12 percent of all deaths in Metro Manila, which is the highest of any city in the country (Table 3.4).

[26] This can be considered a lower bound estimate of economic costs, as it only accounts for the costs associated with cases that are reported to undergo treatment at a clinic or hospital and does not include indirect costs such as pain and suffering associated with having an illness and does not include unreported treatment cases and those for which people do not seek treatment. It also only includes those diseases for which a good correlation to air pollution could be made for the Philippines, and therefore excludes asthma and lung cancer morbidity.

Table 3.1 Proportion of reported disease cases attributable to air pollution in 2004

Disease	Number of reported cases attributable to air pollution	% of all reported diseases
ALRI/Pneumonia (Children <5 yrs old)	92,077	2.9
COPD (Adults)	47,190	1.5
Cardiovascular (Adults)	15,814	0.5
Total	**155,081**	**4.9**

Source: Reported disease cases DOH-NEC 2004a; see methodology section for determination of attributable cases.

Table 3.2 Reported deaths attributable to air pollution in 2002

Disease	Number of deaths	% of all reported diseases
ALRI/Pneumonia (Children <5 yrs old)	1,031	0.3
COPD (Adults)	4,853	1.2
Cardiovascular (Adults)	6,949	1.8
Lung Cancer (Adults)	2,849	0.7
Total	**15,682**	**4.0**

Source: Reported mortality from NSO 2002; see methodology section for determination of attributable deaths.

Table 3.3 Costs of treatment of reported disease cases attributable to air pollution in 2005

Air pollution related disease	Income losses due to reduced workdays (PHP million/yr)	Medical and Hospitalization expenses (PHP million/yr)	Total Cost (PHP million/yr)
ALRI/ Pneumonia (Children <5 yrs old)	24	436	461
COPD >30	22	347	368
Cardio-vascular Diseases	6.4	127	134
Total	**PHP52 (US$1 million)**	**PHP910 (US$18 million)**	**PHP962 (US$19 million)**

Source: Based on reported cases (DOH-NEC 2004a) attributable to air pollution; see methodology section for details. See text for costs of premature death.

Indoor air pollution may also be an important contributor to disease. While comprehensive data on indoor air quality is not available, estimates using global relationships between disease and use of solid cooking fuel indicate that it may be an important contributor to disease in the Philippines, especially in households with poor ventilation. Under conditions where kitchens using solid fuel have good ventilation, it is estimated that indoor air pollution would account for just under 5,000 deaths from respiratory and cardiovascular disease nationally, which is one-third of the total estimated deaths due to air pollution (Table 3.2). The high dependence on solid fuel for cooking in rural areas is estimated to contribute over 70 percent of these deaths.

Table 3.4 Additional deaths due to outdoor air pollution in cities

City	Premature Deaths	% of all reported diseases
Metro Manila	4,968	12
Cabanatuan	134	11
Metro Cebu	608	10
Zamboanga City	240	8
Butuan	104	8
Davao City	414	7
Gen. Santos	117	7
Baguio	102	7
Tacloban	88	7
Iloilo City	204	5

Source: Based on DENR air quality data and dose-response functions. See methodology section for details. Cities included are those with a population over 200,000 monitored by DENR for air quality.

Many rural household use solid fuels for indoor cooking.
Source: R.E.A.P – Canada.

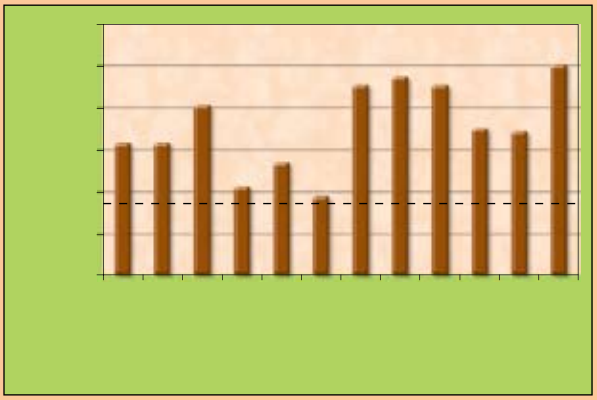
The Risks of Outdoor Air

The health risks of exposure to outdoor air pollution are assessed by monitoring different pollutant concentrations in urban air and comparing them against guidelines established based on health considerations. While there are no minimum levels of air pollution that eliminate health impacts, air quality guidelines can be used as a target to help minimize health impacts and provide a warning sign when levels become high. The guidelines generally recommend maximum concentrations of pollutants for short-term exposure (typically less than a day) and long-term exposure (typically annually), since pollutants can cause acute effects from high concentrations and chronic effects from long-term low-level exposure. Most of the monitoring is done at roadsides, and thus most accurately represents the risk in these areas.

Particulates are at unhealthy levels in Metro Manila. Particulate emissions in Manila are largely from motor vehicles (84 percent), solid waste burning (10 percent), and industries (5.5 percent). Seventy percent of these motor vehicle emissions come from the more than 200,000 diesel-powered utility vehicles—such as jeepneys and the 170,000 gasoline-powered motorcycles and tricycles in the city.[27]

Measurements of total suspended particulates in 2003–04 indicate that all stations exceeded DENR standards and that the average concentration (175 µg/m^3) was nearly twice as high as the standard (90 µg/m^3) (Figure 3.1, Box 3.1). For smaller particulate matter (PM_{10} and $PM_{2.5}$), monitoring has been undertaken regularly since 2000, but in fewer sites.[28] The available data indicates concentrations of PM_{10} and $PM_{2.5}$ exceed standards in some stations and are increasing health risks. Annual average concentrations of PM_{10} range from 30 to 84 µg/m^3; 24-hour mean concentrations were between 32 and 100 µg/m^3, with one site exceeding the guidelines. Annual average concentrations of $PM_{2.5}$ were between 18 and 28 µg/m^3; three sites exceeded the USEPA annual average guideline (15 µg/m^3). Over a 24-hour period, concentrations range between 18 and 75 µg/m^3; half of the sites measured exceeded the USEPA 24-hour guideline (65 µg/m^3).

Figure 3.1 Average roadside TSP levels in Metro Manila, 2003–04



Note: DENR standard is shown by dotted line.
Source: DENR-EMB 2005a.

[27] See ADB, WHO-WPRO, and DOH 2004.

[28] DENR-EMB 2003, 2005a.

[29] Asian Regional Research Programme on Environmental Technology and Manila Observatory 2004.

Health risks of particulate pollution are highest in Valenzuela and Quezon City. Quezon City (along EDSA) and Valenzuela City consistently have high roadside concentrations of particulate matter (Figure 3.2). In these areas, the average PM_{10} concentration is 84 µg/m³. People in these areas were found to have a 17 percent higher risk for asthma and 6.5 percent higher risk of bronchitis relative to people in the lower risk areas of Antipolo and Las Piñas,[30] which had an average PM_{10} concentration of 30 µg/m³.

Heavy motor vehicle traffic in Edsa, Quezon City exposes people to high levels of air pollution.
Source: Bjorn Wahlstedt (left photo); Authors (right photo).

Box 3.1 Levels of particulate matter and your health

Total suspended particulates (TSP) include all particulates of any size, only some of which are of health concern. TSP is used as an indicator of air pollution, as it generally is accompanied by pollutants of health concern, including small particulates and other pollutants from motor vehicles and other combustion processes. DENR has set a guideline value of 230 µg/m³ for short-term (24-hour average) exposure and of 90 µg/m³ for long-term (annual average) exposure.

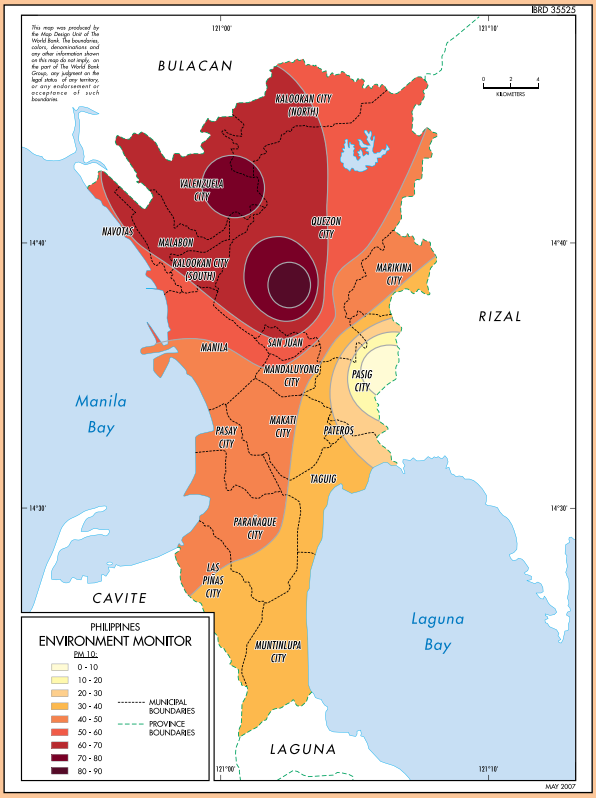
PM_{10} (particulate matter <10 µm) includes smaller particles of less than 10 µm, which are of direct health concern due to their ability to penetrate the lungs. Approximately 55 percent of TSP in Manila is made up of these particles. DENR has set a guideline value for short-term (24-hour average) exposure of 150 µg/m³ and long-term (annual average) exposure of 60 µg/m³. A recent epidemiological study covering 24 barangays in various parts of Metro Manila found that for every 10 µg/m³ increase in PM_{10}, the incidence of respiratory deaths and natural deaths increased by 2.6 and 3.9 percent respectively.[31]

$PM_{2.5}$ (particulate matter <2.5 µm) includes smaller particles, which are the most dangerous to health. Between 35 and 75 percent of PM_{10} in Manila contain these particles. No DENR guideline exists. The WHO guideline is 25 µg/m³ (24-hour exposure) and 10 µg/m³ for long-term (annual average) exposure. These values represent the lower level identified by studies to cause statistically significant health effects.

Source: World Bank 2001; and ADB, WHO-WPRO, and DOH 2004; Manila observatory (percent content of PM_{10} and $PM_{2.5}$); WHO 2006a.

[30] ADB, WHO-WPRO, and DOH 2004.
[31] ADB, WHO-WPRO, and DOH 2004.

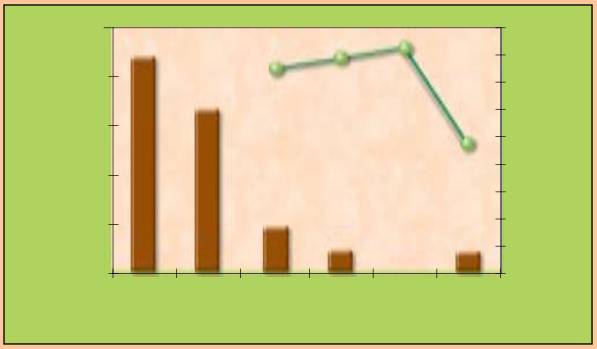
Figure 3.2 Model of PM_{10} concentrations in Metro Manila



Source: Adapted from ADB, WHO-WPRO, and DOH 2004 .

Additionally, over the last 15 years, lead gasoline has been phased out, which has resulted in a ten-fold decrease in ambient lead levels since 1990 to 0.2 µg/Nm³, well below the national guideline of 1.0 µg/Nm³. A recent decrease in lead levels in children may be due to the lead phaseout (Figure 3.3).

Figure 3.3 Ambient lead concentrations and lead in blood of children in Metropolitan Manila



Source: ADB, WHO-WPRO, and DOH 2004

Lower sulfur dioxide and lead concentrations have reduced health risks. During the late 1990s, sulfur dioxide concentrations were steadily rising in Manila due to coal-fired and bunker fuel power plants that operated during that time but have since closed. In 2003–04, sulfur dioxide concentrations at Manila Observatory were on average less than 10 µg/m³, which is two to three times lower than in 1997–98. Similar trends were also found at the Metro Memorial Park station in Parañaque.[32]

Ozone and carbon monoxide may present a potential health risk. Measurements of ozone at one monitoring station at the Manila Observatory exceeded the DENR guidelines, with average concentrations of 60 ppm and 50 ppm over 1-hour and 8-hour periods, respectively. Carbon monoxide measurements at the same station in 1999 indicated that the DENR guideline for 8-hour exposure was exceeded in three out of the four months measured. An estimated 88 percent of carbon monoxide emissions in Manila are from motor vehicles.

[32] Monitoring data from Manila Observatory and DENR-EMB, Central Office.

Box 3.2. Levels of selected outdoor air pollutants and your health

Carbon Monoxide interferes directly with oxygen uptake, causing poisoning at very high concentrations. At low levels, it impacts the nervous system. The DENR guideline is 35 µg/m^3 for 1-hour exposure and 10 µg/m^3 for 8-hour exposure.

Ozone causes direct damage to lung tissue and in high concentrations can cause breathing, eye, and nose irritation. It also contributes to respiratory and heart ailments. The DENR guideline is 140 µg/Nm^3 for 1-hour exposure and 60 µg/Nm^3 for 8-hour exposure.

Sulfur and nitrogen oxides contribute directly or indirectly through reactions with other pollutants to respiratory and heart conditions and disease. DENR has set 24 hour exposure guidelines of 150 µg/Nm^3 for both pollutants. The 1-year exposure guideline for SO_2 is 60 µg/Nm^3. Below these levels, SO_2 has been shown to have health effects at concentrations as low as 10–20 µg/m^3.

Lead in air is primarily from leaded gasoline. Exposure even at low concentrations leads to accumulation in blood and neurological damage, especially among children. The DENR guideline is 1.5 µg/Nm^3 for 3-month exposure and 1 µg/Nm^3 for 1-year exposure.

Volatile Organic Compounds include benzene, toluene, and xylene. Depending on the compound, long-term exposure can cause cancer and immune disorders, and can also affect the nervous system. There are no DENR guidelines. International standards for benzene are 5 ppb (national average-UK); for toluene, 2,000 ppb for 24-hour exposure (Australia); and for xylene, 10,155 ppb over a 24-hour exposure (WHO).

Measurements of volatile organic compounds at the same station found low levels of benzene (2 ppb), toluene (12 ppb), and xylene (1 ppb). While there are no national guidelines for these parameters, these values are lower than available international guidelines (Box 3.2). Similar results have been found for NO_2, where the concentration was between 0.005 and 0.03 ppm, well below the 24-hour guideline value of 0.08 ppm.

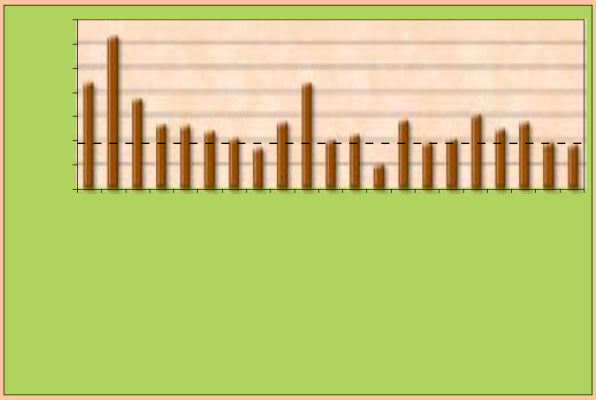
High concentrations of particulates are found in most major cities. Based on monitoring of total suspended particulates (TSP) in 2003–04, 19 cities have average annual concentrations that exceed the standard, with an average concentration of 130 µg/m^3. Very high levels were observed in roadsides in Baguio City, Alaminos City, and Calapan City (Figure 3.4).

Monitoring of other parameters is limited outside of Metro Manila. Data for other parameters is not yet regularly monitored and reported except for a few cities.

Cagayan de Oro. Continuous monitoring data for PM10 in 2003 showed a 24-hour average of between 35–50 µg/m^3 or an annual average of 40 µg/m^3. Both are within the air quality guidelines. Measurements of SO_2 over the same time period also showed levels below the standard (24-hour average between 1 and 13 µg/Nm3 and an annual mean of 4.1 µg/Nm^3.

Davao City. Sulfur dioxide monitoring has indicated low levels with annual averages between 1.4 and 2.0 µg/Nm^3.

Figure 3.4 Average annual TSP levels in major cities and urban centers, 2003–04



Source: DENR-EMB 2005a.

Agriculture and household waste burning is common in rural areas. Burning of household waste emits particulates, organic compounds as well as more persistent and noxious compounds, such as dioxins and PAHs. Nationally, 46 percent of all waste is burned by individual households and the practice is most common in rural areas.[33]

Kaingin (slash and burn practices), charcoal production, and the burning of agricultural wastes and savannah are also seasonal activities that emit large quantities of carbon monoxide and particulates. This can impact the farmers or land owners undertaking the burning as well as the community nearby. The country has over 225,508 hectares of grasslands, 344,671 hectares of land under sugarcane production, and almost four million hectares of land under rice cultivation. Much of this land undergoes periodic burning to remove waste or to otherwise manage the land.

[33] NSO 1998.

The Risks of Indoor Air

While most people are aware that outdoor air pollution can damage their health, globally the worst air pollution conditions have been found in indoor environments. The potentially high risk of indoor air pollution relates to the fact that even small pollution sources can reduce air quality substantially under the confi ned conditions of indoor environments. It is also related to long exposure times to indoor air, especially among women that spend much of their day in households. In the Philippines, indoor air quality, its human exposure and health impacts, have only just begun to be understood. The use of traditional, more polluting household fuels and the high prevalence of smoking have been identifi ed as the major potential risks.

Table 3.5 Percent of households using major types of fuel

	1995	2004	Change
Electricity	84	88	+4
LPG	33	52	+19
Kerosene	80	56	–14
Fuelwood	64	55	–9
Charcoal	39	35	–5
Biomass	29	19	–10

Source: NSO 2004.

Slash-and-burn agriculture is a seasonal activity that contributes to air pollution.
Source: Authors

Most Filipinos are reliant on more polluting sources of fuel. While the gradual move to liquefi ed petroleum gas (LPG) has reduced the use of traditional more polluting fuels, they are still used by more than half the households in the country. In 2004, 55 percent of the country used wood; 34 percent used charcoal; and 56 percent used kerosene (Table 3.5). Levels of indoor air pollution and the exposure from using these fuels are not well studied. However, studies in Metro Manila have shown that the use of fuelwood and kerosene increase hospital admissions and the risk of developing respiratory symptoms relative to that of LPG.[34]

A major factor determining the level of risk is the quality of kitchen ventilation. Use of fuel in more confi ned areas can increase the level of exposure signifi cantly. In the Philippines, this can vary depending on the geographic area and modes of cooking adopted by a given household. In Metro Manila, 90 percent of households have in-house kitchens,[35] while in many rural areas it can vary with the use of outdoor "dirty kitchens" with signifi cant ventilation as well as confi ned household kitchens.

Use of solid fuel such as wood in households without proper ventilation represents a health risk.
Source: R.E.A.P.–Canada

[34] Relative to those using LPG, hospital admissions were 8 percent and 6 percent higher for those using wood and kerosene respectively. Similarly, the risk of respiratory symptoms was 19 percent and 9 percent higher for those using wood and kerosene respectively. See ADB, WHO-WPRO, and DOH 2004.

[35] ADB, WHO-WPRO, and DOH 2004.

Box 3.3 Health and household fuel

Wood and Charcoal. Wood and charcoal are predominantly used for cooking in the Philippines. Charcoal is predominantly used for grilling. Fuelwood use can vary from an in-house kitchen with or without a chimney to a "dirty kitchen" separate from the house. It can include different technologies, including open wood fires and simple clay stoves. These fuels emit soot and fine dust particles, polyaromatic hydrocarbons, and carbon monoxide. Use of these fuels in confined environments has been shown to substantially increase chronic bronchitis, lung and throat cancer, and susceptibility to respiratory illness.

Biomass residues. Agricultural residues—including rice hulls, coconut husks, and shells—are primarily used as a cooking fuel in just under 20 percent of the households. They are generally used as a substitute for fuelwood when it is limited in supply or higher in cost. Air pollution emissions and health risks are similar to that of fuelwood, although lower polluting stoves that utilize rice hulls have been adopted by some households in the Philippines

Kerosene. Forty-four percent of the households use kerosene for lighting while eight percent use it for cooking. It is a cleaner burning fuel than biomass residue, wood and charcoal fuels, but still emits significant quantities of particulates, carbon monoxide, and other more noxious gases. Its use leads to increased incidence of respiratory ailments.

Liquefied Petroleum Gas. Use of liquefied petroleum gas has grown substantially over the last 10 years and is now used in over half the households, almost exclusively for cooking. It is a clean burning fuel producing the lowest quantity of air pollution of all the fuels common in the Philippines.

Source: NSO 2004.

Box 3.4 Environmental tobacco smoke

Environmental tobacco smoke (ETS), also known as secondhand smoke, is a combination of exhaled smoke from active smokers and the smoke coming from smoldering tobacco between puffs. ETS contains the same toxic components as mainstream tobacco smoke, although in somewhat different relative amounts. In 2002, WHO evaluated all published evidence related to tobacco smoke and concluded that there is clear scientific evidence of an increased risk of lung cancer in nonsmokers exposed to ETS. The risks increase 20 percent in women and 30 percent in men who live with a smoker, and about 16–19 percent in the workplace. Exposed nonsmokers also have a 25 to 35 percent increased risk of suffering from acute coronary diseases. Studies have observed more frequent chronic respiratory conditions occurring among nonsmokers who are exposed to ETS. Tobacco smoke is also linked to reduced lung function and exacerbation of asthma. Children whose parents smoke at home have increased risks of suffering from ALRI and Otitis media. WHO estimates that over 50 percent of children worldwide are exposed to ETS in their homes.

Source: WHO Fact Sheet on Tobacco Smoke Pollution, April 2005.

Exposure to tobacco smoke at home is common. Thirty-five percent of Filipinos and 56 percent of males are smokers (Table 3.6).[36] Additionally, 56 percent of school children have parents that smoke.[37] While the impacts on air quality and health have not been systematically assessed in the Philippines, in Manila it was found that children with fathers who smoke have a 60 percent higher risk of asthma.[38]

In urban areas outdoor air pollutes indoor air. Urban air pollution levels have been shown to directly affect the quality of indoor air. In Metro Manila, it has been shown that the areas of the city with higher outdoor air pollution levels also have higher indoor air pollution levels.[39]

Table 3.6 Smoking prevalence among Filipinos (%)

	Overall	Youth (13-15 years)
Males	56.3	21.8
Females	12.1	8.8
Overall	34.8	15

Source: DOST-FNRI 2004; CDC-WHO 2005.

The high prevalence of smoking among adult males in the Philippines is increasing the health risks of environmental tobacco smoke among children.
Source: Authors.

[36] These figures are based on the DOST- FNRI 2003–04.
[37] CDC-WHO 2005.
[38] ADB, WHO-WPRO, and DOH 2004.
[39] ADB, WHO-WPRO, and DOH 2004.

Chapter 4.
Special Focus: Environmental Health, Poverty, and Vulnerability

AGE, GENDER, AND INCOME level have a signifi cant impact on a person's susceptibility and exposure to environmental hazards. People of different ages and genders have unique physiological characteristics that infl uence the extent to which they are affected by disease. It also can affect levels of exposure to environmental pollution. This section presents the factors that infl uence susceptibility and exposure among different groups and their relevance in the Philippines context.

Age

Children are most vulnerable. Children's bodies are in a dynamic state of development characterized by high breathing and metabolic rates and higher nutrient absorption rates than adults. As a result, their bodies absorb more pollutants than the bodies of adults. Furthermore, children's food and liquid consumption in proportion to their body weight is signifi cantly higher than that of adults, which results in greater exposure to ingested pollutants. Children are also commonly exposed more to pollution in their daily lives. They spend a lot of active time outdoors, commonly in unsanitary conditions, and their mouths can be exposed to everything from fi ngers to toys to soil, increasing the likely transmission of disease. Additionally, if children do not practice regular hand washing, the risk of transmission can nearly double.[40]

In the Philippines, 80 percent of the reported cases of diseases attributable to water pollution, sanitation and hygiene affect children. Moreover, while these diseases cause little mortality in adults, they remain a leading cause of death among children. Diarrhea, for example, is not among the top ten causes of death among adults, yet it is the third leading cause of death among children. Similarly, STH cases and deaths occur predominately in children.

This pattern is similar with respect to air pollution. Acute respiratory infections, including acute bronchitis and pneumonia, affect mostly children. As illustrated in Table 4.1, children account for 82 percent of pneumonia cases and 70 percent of bronchitis cases each year.

Table 4.1 Major water and air pollution-related illnesses predominantly affecting children

Disease	Proportion of cases affecting children (%)	Proportion of deaths affecting children (%)
Diarrhea	85	62
Helminthiasis	NA	75
Schistosomiasis	51	0.3
Cholera	78	17
Pneumonia	82	16
Bronchitis	70	47

Source: Includes reported cases only. DOH-NEC 2004a (morbidity) and NSO 2002 (mortality). Morbidity data is for children under 14; mortality data is for children under 10. Bronchitis morbidity includes acute and chronic forms, however among children the acute is expected to predominate. The mortality data covers acute bronchitis.

Children playing in polluted water.
Source: USAID Philippines

[40] Esrey *et al.*, 1991; Hutley *et al.*, 1997; Luby *et al.*, 2005.

The health consequences for the elderly are higher. The elderly are, in general, less exposed to environmental hazards, and hence, are less likely to be afflicted with environment-related diseases. Once they do get sick, however, they are much more likely to die than either children or adults. For many diseases such as pneumonia and schistosomiasis, the elderly account for less than 20 percent of the cases but over 65 percent of the deaths (Table 4.2).

Table 4.2 Major water and air pollution-related illnesses affecting the elderly (>50 yrs)

Disease	Proportion of cases affecting elderly (%)	Proportion of deaths afflicting elderly (%)
Schistosomiasis	18	65
Cholera	7	39
Filariasis	18	57
Pneumonia	9	75
Bronchitis	12	84

Source: DOH-NEC 2004a (morbidity) and NSO 2002 (mortality). Morbidity data is for children under 14; mortality data is for children under 10. Bronchitis morbidity includes acute and chronic forms. The mortaility data covers COPD only.

Gender

Gender also affects vulnerability and exposure to environmental hazards, but this impact varies across age, geographic area, and profession.

Women's bodies are more susceptible to cardiovascular disease. The overall incidence of cardiovascular diseases including those caused by air pollution, is higher in women, accounting for 58 percent of the total.[41] In addition to potential differences in exposure among men and females, one of the main reasons for this is that women's coronary arteries are smaller and their microvessels more frequently dysfunctional than men's. Women with coronary disease also have a higher risk of dying from the disease than men.

Women are more susceptible to diarrhea because of their close contact with children.
Source: World Bank Photo Library

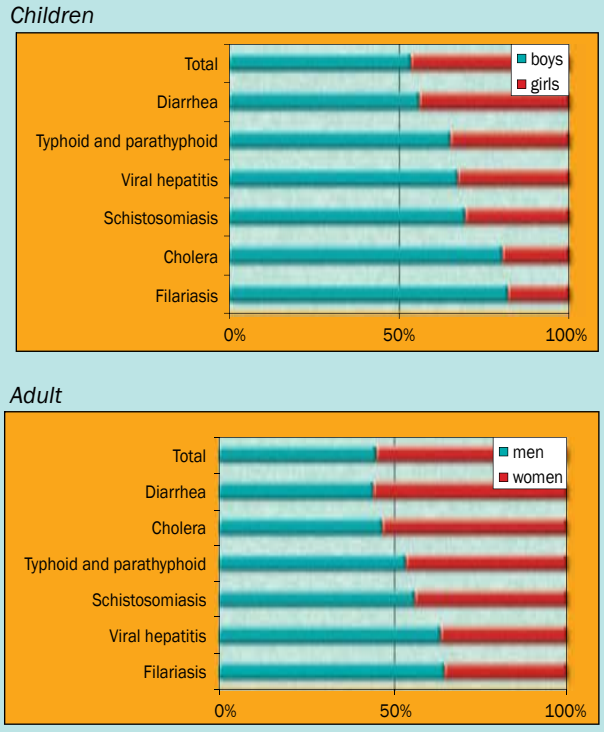
Women can have increased exposure to environmental pollution at home. The disproportionate time that women spend inside the house, especially in households where cooking and heating are carried out using biomass fuels, increases their exposure to indoor air pollution. Women generally spend more time with their children than men do. Contact with children and the associated hygienic risks also increase their risks for contracting diarrhea symptoms, which contributes to the larger incidence of this disease found in adult women (Figure 4.1).

[41] DOH-NEC 2004a.

Men account for 63 percent of reported schistosomiasis cases, mainly due to their exposure to polluted water in agriculture.
Source: World Bank Photo Library

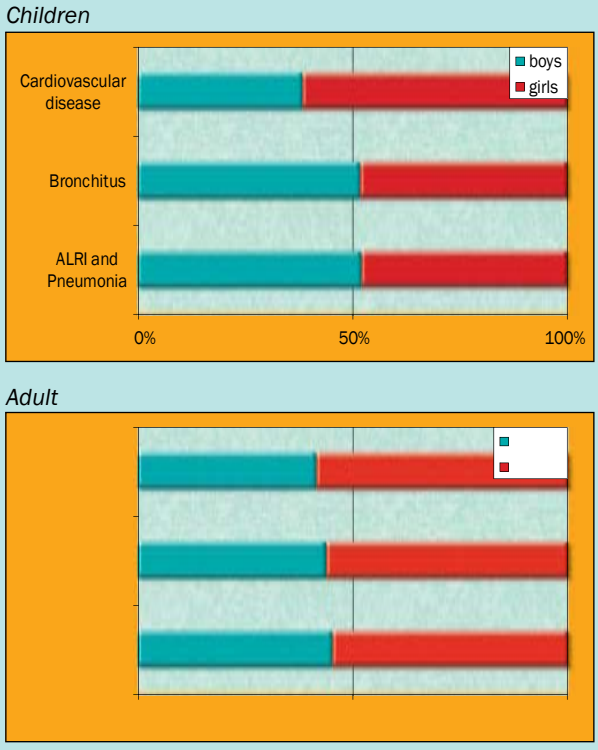
Exposure is a major determinant in disease trends among males. Their everyday work—whether it be on the farm, factory, or as fi sherfolk—can increase exposure to water pollution, poor sanitation conditions and hygiene practices. In general, males account for 55 percent of all water pollution- and sanitation-related diseases in the country. Adult males have a higher incidence of schistosomiasis, fi lariasis, and hepatitis A than women. Among boys, the trend is more pronounced, with higher incidences found in every pollution related disease except cardiovascular disease (Figures 4.1 and 4.2).

Figure 4.1 Gender distribution of reported diseases related to water pollution and sanitation in children and adults



Source: DOH-NEC 2004a.

Figure 4.2 Gender distribution of reported cases of air-pollution related diseases in children and adults



Source: DOH-NEC 2004a.

Poverty

While pollution affects all income groups, the people most at risk are the poor, who lack basic resources and often times, live and work in poor quality environments. On average, provinces with an income less than PHP 100,000 have twice the incidence of diarrhea, a six times higher incidence of typhoid fever, and a 50 percent higher incidence of pneumonia as compared to those with average incomes of over PHP200,000 (Table 4.3).

Malnutrition among the poor is linked to diarrhea. The proportion of children suffering from malnutrition is four times higher among the lowest income households relative to the highest income households (Figure 4.3). Diarrhea contributes to malnutrition as it reduces dietary intake, increases loss of nutrients, and affects absorption of nutrients. Additionally, studies in the Philippines and worldwide have shown increased child mortality from diarrhea and other infectious diseases among those with malnutrition.[42]

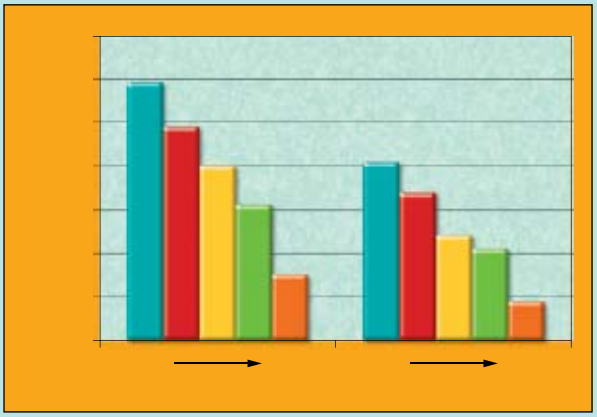
Table 4.3 Incidence of disease (cases per 100,000) by average income

Disease	Average annual income		
	>200,000	100,000–200,000	<100,000
Diarrhea	493	773	898
Typhoid and paratyphoid	4.1	12.0	27.2
Pneumonia	773	1,244.0	1,172.0

Source: Based on DOH-NEC 2004a(provincial disease data), and NSCB, 2005 income data. Represents the overall incidence for provinces in each income category that have reported disease cases.

The poor are more exposed. Access to water supply among the poorest 40 percent of the population is only 70 percent compared to 87 percent of the households in the higher income group. This divergence is even larger with respect to access to sanitary toilets, where only 73 percent of the poorest households have a sanitary toilet, compared to 95 percent of the richer households.[43]

Figure 4.3 Malnutrition in children by income level



Source: FNRI, 2003 as cited in Pedro *et al.*

Poor sanitation in slum areas increases the risk of transmission of water-borne diseases.
Source: LLDA

[42] Rice *et al.* 2000; Yoon *et al.* 1997.

[43] NSO 2002.

Lower income groups are also nearly four times more likely to use fuelwood for cooking and heating and have a higher smoking prevalence.[44] This puts them at higher risk of exposure to indoor air pollution.

An increased susceptibility to outdoor air pollution has also been observed in commuters and drivers, who use forms of transport that are cheaper and more exposed to outdoor air pollution. Jeepney drivers were found to have a 50 percent higher risk of abnormal pulmonary function and a 100 percent higher risk of COPD. Additionally, respiratory symptoms were twice as prevalent in jeepney drivers relative to air-conditioned bus drivers and commuters.[45] Child street vendors have also been shown to have a higher health risk than other children due to their exposure to air pollution and lack of access to health care.[46]

Studies have shown that jeepney drivers and street vendors are susceptible to the health effects of air pollution.
Source: Authors.

[44] Smoking data from NSO 2003a and NSO 2006.

[45] Subida and Torres, 1991.
[46] Subida and Torres, 1994.

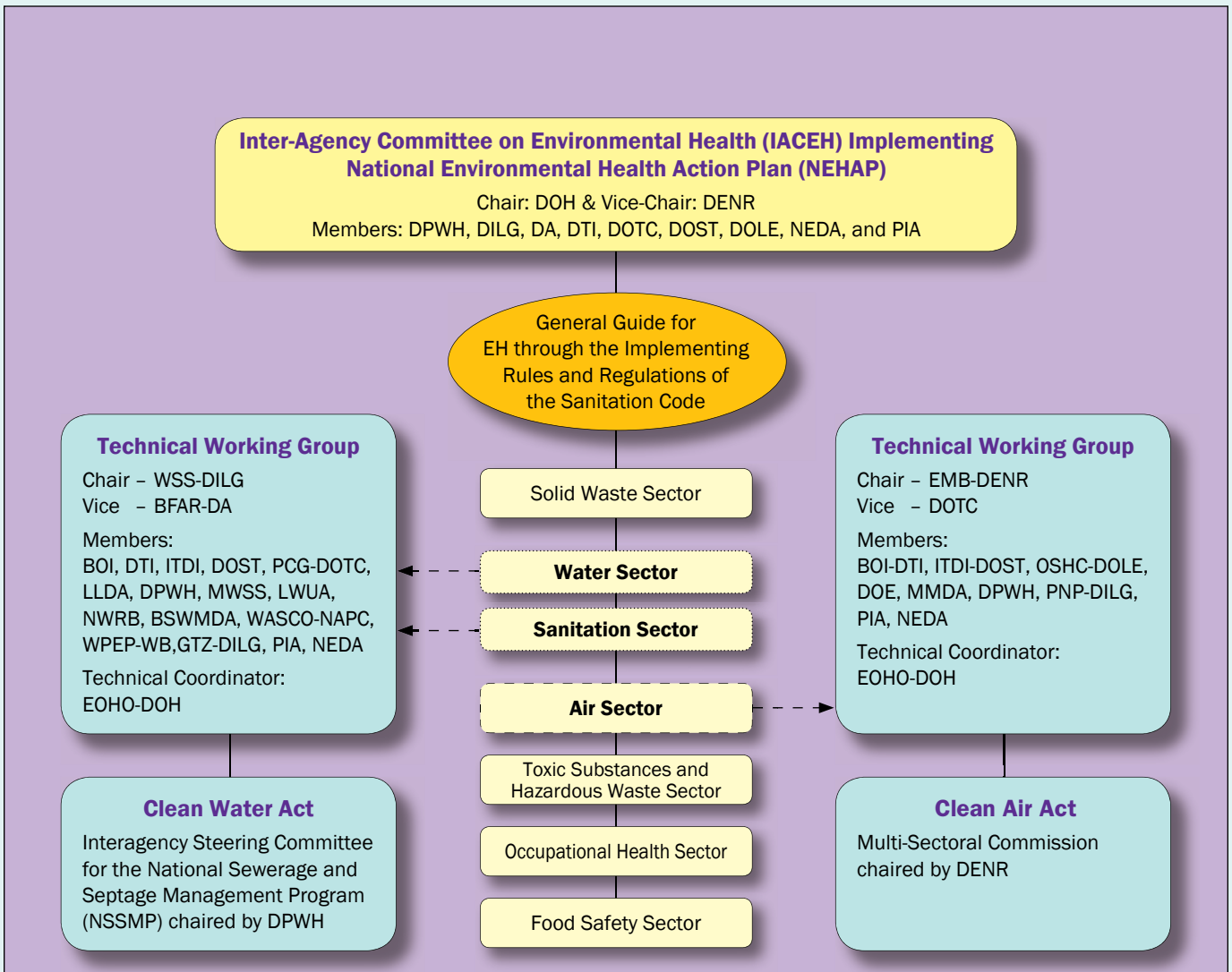
Chapter 5. Legal & Institutional Framework

THE PHILIPPINE CONSTITUTION has embodied the basic right to a healthy environment for its citizens, stating that "the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature" (Section 6, Article II, State Policies). There are two main features of environmental health in the Philippines that affect its governance structure. The first is the fact that environmental issues cut across disciplines and sectors and, therefore, are governed by many laws and agencies making coordination and institutional commitment across agencies a key issue at the national level. Second, the devolution of many health and environment functions in 1991 put local governments in control of many environmental health-related functions, making implementation capacity a key issue at the local level.

Table 5.1 Key laws for environmental health

Law	Health related provisions	Agency I = implementation E = enforcement
Code on Sanitation of the Philippines, PD 856, 1975	An overarching health protection law that includes the National Drinking Water Standards, protection for drinking water sources, sanitation and refuse rules, and public swimming and bathing regulations	DOH (I/E), LGU (I/E), DPWH (I)
Rural Health Act (1954)	Requires sanitary inspectors within the local health unit	LGU
Environmental Health Impact Assessment Act 1994	Environmental health assessment of development projects	DENR (E/I)
Philippine Environment Policy, PD 1151, 1978	Recognizes the right of the people to a healthy environment	DENR (E/I)
Local Government Code, RA 7160, 1991	Devolves enforcement of laws on sanitation to LGUs and the provision of basic services such as health, water supply, sanitation and flood control.	DILG (E), LGU (I)
Pollution Control Law, PD 984, 1976	Establishes guidelines, a permit system, and fines for the control of water and air pollution from industry	DENR-EMB (E/I)
Philippine Environment Code, PD 1152, 1978	Provides guidelines to protect and improve the quality of water resources and defines responsibilities for surveillance and mitigation of pollution incidences	DENR (E/I)
Clean Water Act, RA 9275, 2004	An overarching law with regard to water and its use aiming to protect human health, including source protection through a geographical strategy, effluent standards, new strategies to control domestic sewage, water pollution permits, and criminalization of dumping and discharging	DENR (E/I), LLDA (E/I), NWRB (E/I), LGUs (I), DOH, DAO, DOST (I), LWUA, MWSS (I), DPWH (I)
Philippines National Standards for Drinking Water, DOH Adminstrattive Order 2007	Sets standards for quality of drinking water.	DOH (E), LGUs, LWUA, MWSS (I)
Laguna Lake Development Authority Act RA 4850, 1966 as amended	Regulates and controls pollution of the Laguna de Bay Region.	LLDA (E/I)
Marine Pollution Control Decree, PD 600, 1976 as amended	Regulates and controls the pollution of seas	PCG (E/I)
The Philippine Water Code, PD 1067, 1976	Consolidates legislation relating to ownership, development, exploitation and conservation of water resources	NWRB (E/I)
National Building Code, PD 1096, 1977	Requires connection of new buildings to a waterborne sewerage system	NPWH (E), LGU (I)
Clean Air Act, RA 8749, 1999	Overarching air pollution control law, including enforcement of smoking in public buildings(including vehicles) and implementation of air quality standards	DENR (E/I)
Toxic and Hazardous Waste Management Act RA 6969, 1990	To protect public health from adverse effects of toxic wastes	DENR (E/I)

Governance at the national level. At the national level, environmental health in the Philippines is led by DOH with activities coordinated through the Interagency Committee on Environmental Health (IACEH) (Figure 5.1). The functions of the IACEH are to (a) formulate policies and guidelines and develop programs for environmental health protection; (b) coordinate, monitor, and evaluate environmental health programs and development projects; (c) undertake information dissemination and education campaigns; and (d) coordinate, assist, and/or support the conduct of research and relevant activities for environmental maintenance and protection. The IACEH has also established regional interagency committees for implementation at the regional level.



BFAR – Bureau of Fisheries and Aquatic Resources; BSWMDA – Bureau of Soils and Water Management; BOI – Board of Investments; DA – Department of Agriculture; DILG – Department of Interior and Local Governments; DOE – Department of Energy; DOLE – Department of Labor and Employment; DOTC- Department of Transportation and Communications; DOST – Department of Science and Technology; DPWH – Department of Public Works and Highway; DTI – Department of Trade and Industry; EMB – Environmental Management Bureau; EOHO – Environmental and Occupational Health Office; GTZ – German Technical Cooperation; ITDI – Industrial Technology Development Institute; LLDA – Laguna Lake Development Authority; LWUA - Local Water Utilities Administration; MMDA – Metro Manila Development Authority; MWSS – Metropolitan Waterworks and Sewerage System; NAPC – National Anti-Poverty Commission; NEDA – National Economic Development Authority; NWRB – National Water Resources Board; OSHC – Occupational Health Safety and Health Center; PCG – Philippine Coast Guard; PIA – Philippine Information Agency; PNP – Philippine National Police; WASCO – Water and Sanitation Coordinating Office; WPEP-WB – World Bank's Water and Sanitation Performance Enhancement Project; WSS – Water Supply and Sanitation

The roles of the individual national institutions are as follows:

Department of Health (DOH). Beyond its chairmanship in the IACEH, DOH's role includes development of guidelines, standards, and policies on public health; monitoring implementation (including drinking water standards); development of rules for waste management; and regulating food hygiene. The recent reforms triggered by Executive Order 102 outline a structure based on subnational steering, where the DOH Central Office and its bureaus provide support to regional centers for health development, while LGUs have a large degree of autonomy from DOH. The key bureaus in the Central Office of DOH are:

National Center for Disease Prevention and Control (NCDPC). NCDPC has the Environmental and Occupational Health Office, which is responsible for developing the core environmental health policy related to controlling water-related diseases and policies related to water and sanitation. The Infectious Disease Office is responsible for special disease programs, including schistosomiasis, malaria, filariasis, and soil-transmitted helminthiasis.

National Epidemiology Center (NEC). NEC provides surveillance and survey information through its channels to the Central Office of DOH and is responsible for conducting outbreak investigations and compilation of health statistics.

Bureau of Quarantine and International Health Surveillance (BQIHS). This bureau undertakes international health surveillance required by WHO, such as bird flu containment measures, and is responsible for complying with international commitments made by the Philippines.

Department of Environmental and Natural Resources (DENR). DENR through its Environmental Management Bureau is the environmental pollution regulatory agency. In this role, it formulates and regulates air and water quality, effluent standards, and monitoring of disposal sites and waste management practices. The Laguna Lake Development Authority (LLDA) is also part of DENR and regulates water pollution and sells surface water abstraction rights in the Laguna de Bay Region.

Department of Agriculture (DA). DA manages an inspection system for export standards for fish products and fish processing establishments.

Department of Energy (DOE). DOE sets specifications for all fuel types and fuel-related products, which are then established by the Bureau of Product Standards as Philippine National Standards.

Local Water Utilities Administration (LWUA). LWUA promotes and oversees the development of waterworks outside of Metro Manila.

Department of Public Works and Highways (DPWH). DPWH constructs water supply and sewerage facilities.

Department of Transportation and Communications (DOTC). DOTC, through its Land Transportation Office, undertakes roadside inspection and emissions tests for approval and renewal of vehicle registrations.

National Water Resources Board (NWRB). The NWRB is in charge of licensing water resources for development and overall coordination of water rights.

Governance at the local level. As a result of the devolution of authority for many health and environment functions under the Local Government Code (1991) and related laws, many of the responsibilities for environmental health promotion, protection, and provision of infrastructure lie at the local level.

Local Government Units (LGUs). Under the Rural Health Act and Code on Sanitation of the Philippines, local governments are required to have a sanitary inspector as part of their local health team who is in charge of most environmental health functions, including water supply, food safety, sewage and excreta collection and disposal, refuse disposal, pollution of the environment, vermin control, and industrial hygiene. The functions of the sanitary inspector related to air pollution, water pollution, sanitation and hygiene are shown in Table 5.2.

In addition to the role of the sanitary inspector in air quality, LGUs through their Environment and Natural Resources Offi ce, share responsibility for the management of air quality in their jurisdiction; implement air quality guidelines; prepare air quality action plans; and implement air quality programs to protect the health and welfare of residents in the area.

LGUs by themselves or through private companies also develop and operate public infrastructure, including water supply systems, sewerage and drainage systems, waste treatment facilities, and solid waste collection and disposal facilities.

The Local Health Board is also a key local government-led entity in charge of proposing policies, budgets and appropriations for public health.

Metro Manila. Metro Manila has two special organizations that, in addition to local governments, play a role in environmental health.

Metropolitan Waterworks and Sewerage System (MWSS). Through two concessionaires, MWSS constructs, operates, maintains, and manages water supply, sewerage, and sanitation facilities in the Metro Manila area. It also regulates construction of privately owned sewerage systems.

Metro Manila Development Authority (MMDA). MMDA is responsible for environmental issues, including air quality, that go beyond LGU territorial boundaries in Metro Manila.

Table 5.2 Roles of sanitary inspectors related to air pollution, water pollution, sanitation and hygiene

Water supply	Sewage, excreta and wastewater disposal	Air pollution
Sanitary surveys of water sources	Inspection of sewage and sanitation facilities for structural requirements and contamination of water resources	Enforcement of smoking bans in enclosed public areas
Inspection of water supply systems	Provision of technical advice on installation of facilities	Enforcement of practices for burning of backyard waste biomass
Drinking water quality monitoring	Education and awareness	Identification of major sources of air pollution
Supervision of water disinfection processes	Inspection of establishments with regard to compliance with pollution and waste disposal	Public education and awareness programs
Establishment of domestic water supply surveillance program	Investigation of public complaints related to pollution	Reducing garbage burning through better solid waste collection and disposal
Issuance of drinking water site clearances and certificate of water potability		

Chapter 6. MANAGEMENT RESPONSE

AS A LEADING agency for health governance, DOH has set a vision for the nation's health through Executive Order 102: *Health for All Filipinos* (1999). The vision includes a strong mandate for disease control and prevention. The three broad environmental health goals are as follows: (i) improvement in the general health status of the population, (ii) elimination or eradication of schistosomiasis, filariasis, and malaria; and (iii) pursuing environmental health and sustainable development.

In addition to improvements in health treatment, mass treatment programs (*e.g.* STHs), health manpower development and similar programs to improve the healthcare system, other "environmental health interventions" that focus on preventing environmental exposure are part of the program. These include improved access to sanitary toilets and water supply; improved awareness in disease endemic areas; reduced exposure to water infested with the schistosomiasis vector; hand washing; and footwear usage. In addition, specific actions to increase awareness and improve surveillance are also part of the program. The program sets targets for 2004, including disease incidence levels (Table 6.1). Although not comprehensively monitored, available indicators show that many but not all of the targets have been met. More recently, DOH has championed a program of disease elimination with the goal of declaring "disease free zones" for targeted diseases, including filariasis and schistosomiasis.

The Interagency Committee on Environmental Health chaired by DOH has been active as representatives in global and regional environmental health initiatives, including the development of a National Action Plan for Environmental Health. They also coordinate the response to environmental health emergencies, including pollution and toxic exposure incidents. In 2006, these included a mercury spill at St. Andrews school in Parañaque City, a chemical spill in San Isidro School in Makati City, and the oil spill in Guimaras.

Table 6.1 Selected targets under the National Objectives for Health Disease Prevention and Control

Disease	Objectives	Baseline	Targets 2004	Actual	Units
Diarrhea	Reduce mortality	8.1 (1995)	4.0	4.6 (2004)	Deaths per 100,000 per yr
	Reduce morbidity	1,250 (1995)	1,000	722 (2004)	Cases per 100,000 per yr
Cholera	Reduce outbreaks	12 (1988-1998)	8	6 (2004)	Outbreaks per year
Typhoid	Reduce outbreaks	8 (1988-1998)	6	2 (2004)	Outbreaks per year
Hepatitis A	Reduce outbreaks	1 (1988-1998)	<1	1 (2004)	Outbreaks per year
STH	Reduce prevalence in 25 pilot provinces	54-67 (1995, 1998)	<50 Percent	40-95 (2000, 2003, 2004)	Percent of population
Dengue	Reduce morbidity in 25 pilot provinces	32 (1994)	20	20 (2004)	Cases per 100,000 per yr
Pneumonia	Reduce mortality for children under 5	140 (1994)	120	60 (2002)	Deaths per 100,000 per yr
Schistosomiasis	Reduce prevalence	4.7 (1997)	2.5	3 (2002)	Percent of population

One of the key elements of effective prevention of environmental health-related disease is information that allows national and local governments to set environmental health policies and to target interventions and allow the public and civil society to be aware of health risks. Of particular importance is spatial and temporal information on mortality and morbidity due to endemic diseases, timely epidemiological intelligence of emerging infections and outbreaks, and accurate monitoring information about air and water pollution.

Mortality and Morbidity. Morbidity data is contained in the Field Health Service Information System (FHSIS), which compiles data nationwide from designated health facilities through the provincial and regional health offi ces. It includes many environmental health-related diseases (i.e. diarrhea and lower respiratory tract infections). It is published annually. It is complemented by data on active registration of death by cause, including environment-related disease, which is compiled and published by the National Statistics Offi ce on a regular basis. Both reporting and use are not effectively implemented at the local level, where it is considered more of a requirement for reporting than a tool for public health decision making.

Disease Surveillance. The National Epidemiological Epidemic Sentinel Surveillance System (NEESSS) utilizes hospital admissions from designated health facilities to monitor the occurrence of 14 different diseases in order to provide rapid, timely, and accurate information, and early warning on disease outbreaks, including cholera, hepatitis A, and typhoid fever. The main shortcoming of this system is that it is not able to provide information in a timely manner, at times forcing DOH to rely on other local reporting mechanisms to provide initial information on outbreaks.

Air quality exposure. DENR monitors data on total suspended particulates for 24 cities. Other criteria pollutants are monitored for Metro Manila, Cebu City, Davao City, and Cagayan de Oro City. This data was published in 2003 (2002 data) and in 2005 (2003–04 data). The Manila Observatory also monitors air quality in Metro Manila and Cebu and publishes its data in a variety of research reports. Both systems have set up an online monitoring system designed to provide weekly or monthly updates on air quality. Neither online system has been regularly updated. In addition to the lack of publicly available real-time data, limited use and analysis at the local level limits its effectiveness.

Water quality exposure. The Water Quality Management Program of DENR-EMB is taking the lead in surface and groundwater monitoring. Periodically, they publish a water quality status report that provides data for rivers, lakes, and bays (including their classifi cation for use) in all regions of the country. DENR also spearheaded a public disclosure program for groundwater ("Tapwatch"), industrial pollutors ("Ecowatch"), and beaches ("Beachwatch"). Additionally, the performance of the water treatment plants for some water utilities in the country is reported. Bottled water and water refi lling stations are similarly monitored by DOH. The quality of water in water distribution systems and from informal water vendors is not commonly monitored and reported (except in Manila).[47]

[47] For example, Metro Manila Drinking Water Committee is mandated to meet once a month to monitor drinking water in Manila.

Monitoring of water quality is undertaken regularly in the Philippines.
Source: USAID Philippines

Red tides. The Bureau of Fisheries and Aquatic Resources (BFAR) monitors seawater and organisms for red tide toxins. Based on the results, DOH and BFAR publish red tide updates that outline the areas that are banned for shellfi sh harvesting.

Public investment in water supply and sanitation is estimated to be three to four billion pesos per year. These are fi nanced through the national government, local governments, LWUA, and through the Manila water concessionaires. Sewerage and sanitation investments are only a fraction of total investment, amounting to PHP500 million (US$10 million) per year. The majority of the investments have been through LWUA (53 percent over last ten years) and in Metro Manila (50 percent of total investment over the last fi ve years).[48] Local government-sourced fi nancing has largely focused on operational costs of maintaining these systems.

It is estimated that to reach the Millennium Development Goal for water supply, an investment of six to seven billion pesos (US$120-140 million) per year is necessary. For sanitation and sewerage, an average of PHP25 billion (US$500 million) per year in investments is necessary between now and 2015 to improve the situation.[49]

Investments in basic sanitation have made a large impact. Largely private investment in sanitary toilets has increased access to basic sanitation substantially since 1990. This is one of the major contributing factors to the reduction in disease incidence from water pollution, sanitation and hygiene-related illnesses. In contrast, public investments in sewerage have only increased sewerage coverage in urban areas nationwide to fi ve percent. Additionally, while half of the households in the country have septic tanks, facilities for proper treatment of sludge from these tanks cover less than one percent of the population.[50]

Millions of toilets such as these have been purchased in the Philippines in the past decade.
Source: Water and Sanitation Program, Philippines

[48] World Bank 2005.

[49] Detailed investment estimates are in World Bank 2005.
[50] See chapter 2 for data.

Water resource development is limiting potential health improvements from water supply. Groundwater is the source of 86 percent of the piped water supply in the country.[51] The dependability and sustainability of the groundwater resources is questionable in many urban centers due to the increasing extraction, increasing groundwater contamination from poor sanitation systems, and salt water intrusion in coastal areas. Surface water resources are also less available with only 40 percent of the surface water classified for use as a public water supply[52], and most urban rivers are severely polluted. This is forcing some localities to look for more expensive and technically complicated water resource options to meet current and future demand. The slow development of these water resources has contributed to the inability of water utilities to keep up with demand for connections from the growing population (Box 6.1).

Box 6.1. Water supply in Metro Manila and Metro Cebu

Manila and Cebu are the largest metropolitan centers in the country and, due largely to limited water resources, provide only 67 percent and 40 percent of their respective populations with household connections.

Demand for water (MLD).	**2000**	**2025**
Metro Manila	3,800	8,000
Metro Cebu	254	520

Current water resources development. MWSS in Metro Manila obtains 97 percent of its water from the Angat Dam, which can provide 4,000 MLD. The Metro Cebu Water District produces 130 MLD from groundwater. In both cities, groundwater resources are being extracted beyond their recharge capacity, resulting in saline intrusion and contamination from sewage.

Future water resource plans. In Metro Manila, the strategy being pursued is to reduce the losses of water in the system and expand resources by building a plant to treat water from the polluted Laguna de Bay to drinking water standards plus a US$1 billion dam in Rizal Province. In Metro Cebu, studies for future water resource development have looked at a combination of groundwater and surface water to increase the capacity of MCWD to 418 MLD by 2025.

Source: Water use in Metro Manila and Metro Cebu, C. Bumatay, NWRB

[51] Based on the water rights granted by the NWRB since 2002.

[52] DENR 2005b. Out of the 525 classified rivers, only 208 are class A or better, meaning they can be used as public water supply after treatment.

Box 6.2. Infrastructure and health in Metro Manila

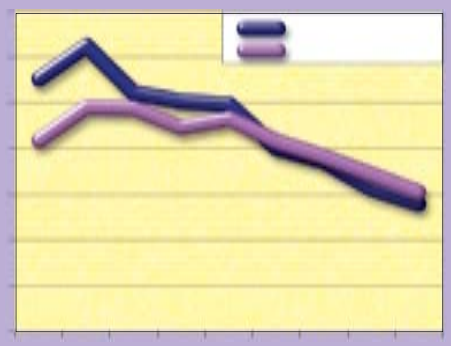
Suffering from nearly nonexistent sewerage and sanitation service, inadequate water connection coverage and service levels, leaks in water pipes, and increased risks of waterborne disease, Metro Manila in 1997 took an ambitious approach to provision of water supply and sanitation. At that time, operation of the water supply and sanitation services was handed over from Metropolitan Water Supply and Sanitation Service (MWSS) to two private companies for a concession period of 25 years. The companies had specific targets for expanding and improving service levels for both water supply and sanitation that would be regulated by MWSS. The goals and achievements of the privatization have reduced health risks, although there are many other contributing factors to this trend, including improved basic household sanitation.

Increased household connections. An additional 491,000 water supply connections in the east concession and 175,000 in the west concession have provided millions of people the opportunity to increase their water consumption. With more water available for cleaning and general hygiene, important health benefits were achieved.

Improvements in water pressure and leakage. Improvements in water pressure and leakage reduced the risk of contamination of the water supply in the distribution system and improved financial revenues through reduced non-revenue water. The east concession made substantial improvements in leakage and water pressure through a pipe replacement program that improved their non-revenue water by 14 percent and increased average water pressure from 7 to 11 psi. The west concession reduced leakage through non-revenue water less substantially (5 percent) and has an average water pressure lower than that of the east zone (7 psi).

Sanitation. The concessionaires are largely responsible for maintenance of septic tanks, sewerage, and wastewater treatment. Progress has been slow, however, with the proporation of households connecting to sewers growing from 8 to 15 percent during this time, with only half of that being treated in wastewater treatment plants. The number of septic tanks maintained increased from incidental levels to two percent in 2004. Ambitious plans by one of the concessionaires (Manila Water) may improve this situation over the next five years.

Figure 6.1 Diarrhea incidence in Metro Manila



Source: DOH-NEC 2004a.

Since 1996, Diarrhea has decreased substantially in Metro Manila, with incidence down 50 and 40 percent in the east and west concession areas respectively. Similar trends exist for paratyphoid and typhoid. In the west concession, cholera outbreaks are still common in Pasay City (9 cases per year) and Quezon City (31 cases per year), while they have disappeared in the City of Manila. The east concession area never had substantial cholera outbreaks.

Implementation of the Clean Air Act. The Clean Air Act was passed in 1999, followed by the implementing rules and regulations in 2000. Implementation was comprehensively reviewed in the Philippines Environment Monitor 2002. It reported some success in implementation, but not yet to the point where outcomes were being felt. Since that time, more concrete measures have been developed that are likely to have health outcomes. These include:

Emissions standards.

- A standard for hydrocarbon emissions from motorcycles and tricycles in urban and rural areas was established in 2003.
- Emissions standards for in-use motor vehicles were updated and harmonized, providing for separate standards for vehicles registered before and after January 1, 2003.
- Smoke capacity standards for in-use diesel vehicles were revised to set emissions standards covering all diesel vehicles.

Emissions testing in Mandaue City.
Source: City of Mandaue Air Management Program

Emissions testing. Requirements for an emissions test before registration began implementation in 2003. Since then, 377 accredited emissions testing centers were established. DENR has been actively monitoring these centers and issued 69 temporary suspensions and eight cancellations of permits in 2004. Challenges still remain on governance, uniform testing procedures, and results interpretation.

Smoke belching is prohibited under the law and reported belching vehicles are apprehended.
Source: DENR

Anti-Smoke Belching. 16,250 diesel-fed vehicles were apprehended for smoke belching.

Fuel standards. Fuel standards have been established for diesel oils, two-stroke lubricating oils, coco methyl esters, and LPG for motor vehicle fuel. This has resulted in:

- A reduction in aromatics and benzene in gasoline to 35 percent and two percent by volume, respectively.
- A reduction in the sulfur content of automotive diesel fuel to 0.05 percent.

Alternative fuels. In addition to encouraging the use of coco methyl ester, compressed natural gas, and liquefi ed petroleum gas in transport as part of the Clean Air Act activities, the Biofuel Act was passed in January 2006. It will require all diesel fuel to contain one percent biodiesel and all gasoline to contain fi ve percent ethanol. However, the health benefi ts of replacing gasoline with ethanol use are still under debate.

The Clean Water Act was passed in 2004. It is intended to manage water quality in designated water quality management areas through a combination of multi-sectoral planning and regulatory controls and incentives on polluting sources, including barring the expansion of polluting sources in water quality management areas designated as nonattainment areas. It includes the preparation of a National Sewerage and Septage Management Program that requires connection of households and businesses in major urban areas to a sewerage system and at the same time provides funding opportunities.

It also includes the implementation of wastewater discharge permits and charges. The revenues from these fees will be used for investments to improve water quality. The act is still in its infancy; considering the fi nancial resources needed to make substantial improvement in the treatment of domestic wastes water in particular, it will take time to have an impact. Accomplishments thus far include:

- Completion of the implementing rules and regulations in 2005.
- Publication of the Regional (Regions 3, 6 and 12) and National Water Quality Status Reports.

In addition, DOH has recently established drinking water standards, strengthened the regulation of water supplied by water vendors and bottled sources, and has undertaken training on sanitary inspectors on the topic.

The Clean Water Act requires proper treatment of wastewater.
Source: USAID Philippines

SINCE THE DEVOLUTION in 1991, the focus of implementation of environmental health programs has shifted to local governments. While widespread implementation still remains a challenge, many promising programs have been initiated—in partnership with the private sector, NGOs, and donors—by forward looking leaders and champions. Some have proven successful, while for others it is still too early to tell.

Managing septic tanks. While nationwide septic tank maintenance remains very low, programs in Manila and in some LGUs show a growing commitment to address this issue.

Regular desludging is undertaken in many parts of Manila.
Source: Authors.

In Manila over the last ten years, septage management has grown through private contractors and programs of the two private water concessionaires. Through the Manila Third Sewerage Project, this will be expanded, with the goal of maintaining 80 percent of the septic tanks in the east concession area and treating the waste sludge using treatment plants constructed under the project. The remainder will be left to private contractors that are currently not actively regulated for disposal practices and do not have a formal program of accreditation, providing an opportunity for open dumping of the septic sludge. In response to this gap, the project will develop regulations and standards for these contractors.

The municipality of Muntinlupa has developed creative means for reaching out to the public. The Public Information Offi ce of the City has taken the lead in raising awareness of the need to manage septic tanks. The program—referred to as "Poso Negro"—uses an innovative approach that employs provocative materials that take on the issue directly. One example is the use of images of families drinking water poured from a toilet coupled with the message that people should "check your septic tank or swallow the consequences."

Reducing pollution from tricycles and motorcycles. Several successful LGU-led initiatives have been implemented in the country to help reduce particulate matter emissions from highly polluting tricycles and motorcycles.

In San Fernando City, La Union, the city government has successfully phased out the nearly 1,200 highly polluting two-stroke motorcycles and tricycles, which have been in use in the city for nearly 30 years. In exchange for switching to a four-stroke vehicle, drivers were offered concessional loans with a two-month moratorium on

payments, an interest-free repayment plan, and a free driver's uniform with sun protection features. The initiative, which is part of San Fernando's City Development Strategy, resulted in the complete phaseout of these motorcycles and tricycles within its first year of implementation.

Source: USAID Philippines and Municipality of Puerto Princesa.

In Puerto Princesa City, the local government has introduced a "50/50" scheme to reduce the pollution from tricycles and three wheel taxis traveling in the city. The program includes training in proper maintenance, and limiting the operation of trycicle taxis to four days per week. It has succeeded in reducing the number of tricycles and motorcycle taxis on the street by 50 percent with no reduction in income of the taxi drivers. The maintenance program has reduced hydrocarbon and carbon monoxide emissions by 40 and 30 percent respectively.[53]

Delivering water to poor communities. Programs to deliver water supply to poor communities in both rural and urban areas are numerous and include work by LWUA, DSWD, the private sector, and many donor projects. An important challenge for this work has been in reaching poor communities in urban areas, many of which are informal settlers without land tenure.

While other major cities in Asia have not been able to address the technical and legal barriers, Manila has been able to provide safe affordable water to many of its poor communities. Many of the poor in Metro Manila are dependent upon informal water vendors, who sell water of uncertain quality at prices that require families to expend between 8 and 20 percent of their income on water. This often forces them to use less water, forgoing important hygiene and health benefits.

Programs developed by the water concessionaires in Manila have allowed poor households to obtain water connections, increasing water use by as much as six times while lowering expenditures on water by between 40 and 60 percent. The savings in the time necessary for retrieving water have been shown to result in more time spent on income-earning activities. The programs do not require land titles to install the connections, and they provide lower connection fees and installment programs for payment. As of the end of 2005, the programs combined have provided 1.6 million people with water connections.[54]

[53] USAID, Clean Air Toolkit for Local Governments, part 3 Clean Air Program Case studies.

[54] ADB, 2002. Data is from MWSI and MWCI for 2005. Costs and water use are based on a survey of households in the west concession area in 2006 and Aiga and Umenai, 2002.

Wash your hands! Programs to encourage hygiene in the country have been underemphasized, considering the potential health gains they hold. Several groups, however, are actively involved in programs such as the Water Sanitation for All ("WASH") program and hospital and university-led hygiene promotion campaigns. The *Molave Development Foundation, Inc.*, a nonprofi t group working on the front lines of environmental health advocacy, has developed useful materials for hygiene awareness. The materials are information technology-based modules that provide a fun and effective means of communicating the importance of hygiene.

Materials developed through multi-stakeholder "write-shops" include "Safe water and clean environment for a healthy school," "Your health is in my hands"(for food preparation), as well as others targeted for hygiene and sanitation in the home and on the farm. They disseminate the materials in community "WASH" days in poor communities and schools in Manila and through a "WASH" Caravan that will visit targeted municipalities to promote the water and sanitation Millennium Development Goals.[55]

Treating domestic wastewater. Installation of treatment systems for domestic wastewater—by LGUs and other local organizations—has been very limited outside of Metro Manila, in part due to the cost. With the Clean Water Act, several initiatives have been developed, including those targeted toward improving water quality for beach recreation.

Lilo-an, a beach community that is enjoyed by visitors from Cebu City, has taken steps to improve water quality to protect swimmers' health. In response to declining tourism income as a result of increased pollution, the Lilo-an municipal government—in partnership with the ADB, DENR, and the Lilo-an Community Multipurpose Cooperative—built a rotating biological contactor treatment facility to collect and treat waste from residential sources and the market and treat it. The treatment facility is a fi rst step in maintaining fecal coliform levels within the criteria for bathing water along the Lilo-an coastline. Boracay, a beach community in Caticlan, has also developed domestic wastewater treatment systems in response to similar economic threats of poor water quality. DENR is encouraging beach communities such as these to make similar investments through their Beach Ecowatch program, which monitors beaches for coliform bacteria and other parameters indicative of its suitability for recreation. The resulting knowledge of water quality allows resort owners and municipalities to design programs to reduce pollution as needed. As part of the program in 2005, DENR tested 26 beaches in the country and reported that one third of them failed to meet water quality standards for bathing.[56]

Technologies for better health. As part of local government and NGO-led programs, technologies have been introduced to reduce environmental risks in the Philippines.

[55] The program partners include the Water Supply and Sanitation Collaborative Council, which sponsors the Water and Sanitation for All (WASH) campaign globally; UNDP; NEDA; City Schools of Manila; and PLAN Philippines.
[56] DENR-EMB 2005b.

Improved Biomass Cookstoves. Rice is the staple food in the Philippines which has nearly four million hectares devoted to rice farming. It is, however, also a major source of pollution in rural areas, as rice residues are often burned, creating localized air pollution problems. Many Filipinos also use rice hulls for cooking fuel, which generates indoor air pollution. Several groups have developed rice hull stoves designed to reduce indoor air pollution and also provide an effi ciently burning fuel source. Among the groups include PhilRice, IRRI, Central Philippine University, and REAP-Canada. Dissemination has been signifi cant, with thousands of these stoves adopted in communities throughout the Philippines.

Mayon Turbo rice hull cookstove.
Source: R.E.A.P.–Canada

Providing safe rain water for drinking. An initiative designed to bring safe water to poor communities has been launched in the Tawi-Tawi Island group (ARMM region), which is among the poorest provinces in the Philippines. In many communities, existing dug wells contain water that is unfi t for human consumption and rainwater is a more reliable source of safe drinking water. In the past, people collected roof runoff in small containers, which was not sustainable. In periods without rain, people had to travel long distances to other islands to buy drinking water at high prices.

In 2004, the Philippine Center for Water and Sanitation piloted the ferrocement technology for building large rainwater harvesting tanks in ten barangays of South Ubian, Tawi-Tawi. Ferrocement is about 80 percent cheaper than conventional construction methods, and reportedly lasts up to 50 years. Under the PCWS initiative, 65 containers of three cubic meters and ten containers of 11 cubic meters were built, providing the households in South Ubian with a cheap, safe and reliable water supply system. Since its initial success, this project has been extended to the remaining nine neediest municipalities in this province.

Ecological sanitation. Ecological sanitation has been implemented in the Philippines through an innovative sanitation scheme that provides safe sanitation to poor households and helps alleviate groundwater pollution and water scarcity problems. The technology involves separation and treatment of the urine and feces for their subsequent use as agricultural fertilizer. The Ecosan technology does not rely on clean drinking water for fl ushing, and hence it does not generate signifi cant amounts of wastewater. It has been implemented at a pilot level in several areas of the country. In San Fernando, La Union 1,217 toilets and 310 urinals were installed as part of a partnership with WASTE, GTZ, and the Center for Advanced Philippines Studies.

Chapter 7.
Imminent Environmental Health Challenges

ENVIRONMENTAL CONDITIONS IN the Philippines are contributing signifi cantly to the health and economic burden in the country. Air pollution, water pollution, sanitation conditions and hygiene practices alone are responsible for nearly one-quarter of all reported diseases and six percent of all reported deaths in the country. The cost—in terms of treatment and lost income alone—amounts to PHP14.3 billion (US$287 million) each year.

Most at risk are the 25 million people without access to improved sanitation facilities and the 13 million people without improved sources of water. Commonly contaminated water supply systems and heavily polluted urban drainage systems and rivers are also increasing risks. The major air pollution-related risks affect the 18 million people in urban areas with particulate matter concentrations above DENR standards, largely as a result of emissions from motor vehicles. The 46 million people using fuelwood for cooking may also have elevated risks from air pollution, especially those with poorly ventilated kitchens.

There has been important progress in reducing these health risks through environmental improvement. Over the past 15 years, the reported incidence of diseases related to water pollution, sanitation conditions and hygiene practices has declined by 50 percent, when there were substantial improvements in access to improved water supply and basic sanitation. Additionally, levels of several air pollutants have dropped substantially in Manila. Through the Clean Air Act, initiatives have been introduced to reduce pollution from motor vehicles, including the introduction of emission and fuel standards; programs to reduce pollution from motorcycles and tricycles; and the strengthening of the vehicle inspection system. The gradual switch from fuelwood-based cooking to liquefied petroleum gas is also encouraging news.

Table 7.1 Health burden of air pollution and water, sanitation and hygiene

	% of reported diseases	% of reported deaths	Economic costs (PHP billion/yr)
Air pollution	5	4	**7.6**
Water pollution, sanitation	17	1.5	**6.7**
Total	**22**	**5.5**	**PHP14.3**

Continual improvement of environmental conditions to address health problems requires a truly multiagency, multidisciplinary approach. Several key elements of an effective environmental health system include a strong interagency commitment to the environmental health agenda; responsive and effective use of information by government and the public; well functioning and well-designed infrastructure; and environmental and health regulations that effectively reduce health impacts. The Philippines has the basic institutional framework to address these issues. To help further reduce health impacts caused by a poor quality environment, the following are the immediate priorities:

Challenge 1: Raising the profi le of the environment's role in health

The 1999 National Objectives for Health presented a multifaceted response to disease prevention that included many environmental health-related illnesses. Many of the disease targets under the plan have been achieved and even exceeded, due in part to the program's treatment interventions and measures aimed at reducing exposure to environmental risks.

Diarrhea incidence, for example, has declined by 43 percent, typhoid and cholera outbreaks have reduced, and pneumonia deaths in children under five have dropped by 60 percent. Schistosomiasis incidence was also reduced by 40 percent.

In addition, the Interagency Committee on Environmental Health (IACEH) is a key organization both in terms of leadership and coordination. The committee has played an important role in reacting to emergency toxic releases and advising on policy. Most importantly, it has taken the lead in the process of development of the National Environmental Health Action Plan.

In spite of these successes, the environmental health agenda does not have the broad-based government support and political profile that an interdisciplinary issue with such important health implications should have. The successful experiences of DOH in disease prevention and the IACEH's pivotal role, are a starting point in bringing the environmental health agenda to the forefront of the health, environmental protection, and development agenda. Particular challenges are for DOH to raise the institutional profile of environmental health through its plans and programs and to build capacity at the local and national level on environmental health issues to mainstream them throughout the health system. DENR and other agencies also need to provide a strong commitment to support this agenda by bringing environmental health issues into their policies and programs, as well as working proactively with other agencies through the IACEH. The central role of the IACEH in facilitating these changes needs to be supported through better definition of the role and accountabilities of the committee and its members, expanding IACEH resources and activities, and supporting the national and regional IACEH to enhance their pro-active role in mainstreaming environmental health.

Challenge 2: Useful and easy to access information

Providing accurate and reliable information on environmental health risks and remedies is crucial for policy makers and practitioners to make decisions and is a prerequisite for active engagement of advocacy groups and the general public in environmental health. DOH and DENR have developed nationwide systems for disease surveillance and monitoring air quality and water quality to provide publicly available comprehensive reports. However, use of these systems by policy makers has been constrained by gaps in the timing and quality of data. Additionally, advocacy materials that can be used by the public, schools, local governments, and NGOs have been developed by various groups; however, they do not cover all topics, and access to these materials is variable.

Providing the right information. Considering deadly outbreaks of cholera and typhoid are still prevalent in the Philippines, an immediate priority for disease reporting is to improve surveillance systems in order to allow DOH and local authorities to better react to disease issues as they emerge.

The completeness and timeliness of exposure data also could be improved to be more responsive and useful. In particular, online air quality systems need to become functional and be used to inform the public of the risks. Monitoring should also be expanded to better focus on health risks through regular

measurements of PM_{10} for air quality, and expanding the monitoring program for bacteria to include a larger number of monitoring sites for those areas with potentially high health impacts such as urban drainage systems, groundwater, and water supplies. The gaps in information on the health risks of indoor air pollution, garbage, burning, and agricultural waste burning also need to be fi lled through a national study.

Information on environmental health for the purposes of advocacy and public awareness is also a priority issue as it is limited to a few environmental health topics. Working from the existing good practices examples, similar materials can be developed for a range of environmental health issues and localities.

Getting information to the right people. Currently, there are limited mechanisms for national and local governments, hospitals, and other practitioners and policy makers to access and share environmental health information. The challenge is to develop a coordinated mechanism to both disseminate reliable information and to share information and experience among practitioners and policy makers. This would result in better coordination between agencies and local governments, and would encourage better use of the data in decision making and planning.

From a public awareness perspective, the lack of readily available information has limited the engagement of local governments, the public, advocacy groups and other organizations on environmental health. Providing a mechanism for systematic dissemination of this information is thus an important opportunity to improve health. In particular, more widespread dissemination of information in basic water, hygiene and sanitation issues—including hand washing, water-source protection, and sanitation facility design and use—could have an impact in underserved or vulnerable communities.

Challenge 3: Infrastructure for better health

Since 1990, an additional 24 million people acquired basic sanitation facilities and an additional 18 million people acquired household water supply connections. These improvements have coincided with reductions in infectious diseases in the country, including diarrhea. Looking ahead, as with many countries at the same level of development, the Philippines faces the dual challenge of ensuring access to basic water supply and sanitation facilities to underserved groups, and reducing the health risks of the remainder of the population due to the inadequacies of their water supply and sanitation infrastructure and services.

Filling the gaps in basic sanitation. Currently, 25 million Filipinos still lack access to basic sanitation. This underserved population is more heavily concentrated among low-income groups, where coverage is 22 percent lower than higher income groups and in certain regions such as the ARMM, where the proportion of households with sanitary toilets is 32 percent lower than the national average. Due to the susceptibility and inherent disadvantages of these groups, including access to know-how and capital, many will be left behind without special programs. The immediate priority is to ensure basic sanitation is integrated into targeted poverty reduction programs in slum areas and lagging regions. Targets for these groups should also be monitored as a complement to the Millennium Development Goals.

Expanding water resources. In urban areas, despite improvements in the number of household water supply connections, the proportion of people with access to improved water sources that could help ensure safe drinking water and improved hygiene has decreased from 95 to 87 percent between 1990 and 2004. One important reason for this is that the contamination of surface water sources and overabstraction and contamination of groundwater have constrained the water available to meet the growing demand in cities, thus, forcing a portion of the population to rely on less reliable sources of water. While this underlines the importance of protecting water resources in the long run, it also highlights the short-term need to mobilize large capital outlays for water resource development. Government budgets cannot support these investments at present. Therefore, public-private financing schemes for water-source development will have to be explored.

Reducing health risks of polluted surface and groundwater. An estimated 95 percent of the wastewater fl owing from urban households in the Philippines is transported into groundwater or public canals and drainage systems, and eventually into rivers and bays. As a result, drainage systems and rivers in major cities have very high levels of bacteria. Rural areas are facing similar health risks from untreated waste, for example, waste in agricultural fields in schistosomiasis endemic regions.

Additionally, surveys of water supply from wells have found that at least 30 percent of sampled wells are contaminated by bacteria; piped water systems can show similarly high frequency of contamination. In addition to contributing to the endemic disease burden, outbreaks of cholera, typhoid, and diarrhea due to contaminated water supplies are common.

These health risks are commonly overlooked in water resource infrastructure development in the country. For example, design and maintenance practices can put water supply systems at risk and a lack of sewerage and wastewater treatment systems increases exposure to domestic waste. The main challenge here is two-fold: (1) reducing exposure to contaminated water by covering open drainage systems where they exist, and enforcing standards for siting and design of wells and drinking water distribution systems; and (2) developing a strategy that integrates wastewater considerations into water resource planning by providing a fl exible approach that can be catered to different situations to provide low-cost solutions and the necessary financial incentives to make sewerage and wastewater treatment more affordable and sustainable.

Challenge 4: Improving Regulation

Along with the Code on Sanitation, the passage of the Clean Water and Clean Air Acts have provided a robust framework for improvements in environmental health. Initiatives under the the Clean Air Act are now taking shape on the ground, while the Clean Water Act is only just beginning to be implemented. As these important pieces of legislation move forward, the key challenges are to support the local governments in environmental health regulation and to use the Clean Air Act to target air pollution control to the polluters with the highest health impact.

Strengthening local regulation. At the local-government level, the sanitary inspector is a key player for on-the-ground implementation of environmental health protection, covering such functions as inspection of water supply and sanitation systems and enforcement of laws on backyard waste burning. Additionally, initiatives such as the successful programs in San Fernando, La Union, and Puerto Princesa to control air pollution from motor vehicles have been led by local governments. While the devolution of public health and environment functions to local governments is an important opportunity to create an enabling environment for responsive local solutions to local environmental health issues, the capacity of these groups is weak. Strengthening them could potentially result in large health improvements.

The first key challenge will be to clarify the strategic approach of the DOH vis-à-vis local governments in light of devolution, the Code on Sanitation, and the Clean Water and Clean Air Acts. This will both help clarify what is expected of local governments, and enhance DOH's ability to provide oversight.

The second key challenge is to expand the program of training for sanitary inspectors by DOH, as well as the programs for local government air pollution capacity building by DENR. Priority issues would depend on the locality. In general, the regulation of septic tanks, monitoring of water supply systems, and sanitation system design would have high health impacts in areas where they are deficient. Similarly, cities suffering from air pollution from mobile sources would be able to maximize the health benefits from programs targeted at reducing motorcycle, jeepney, and tricycle emissions.

Reducing particulate matter emissions from commercial vehicles. Motor vehicles account for much of the particulate pollution in the urban areas of the country. In Metro Manila alone, vehicles account for 84 percent of the particulate emissions, with motorcycles, tricycles, jeepneys, and other utility vehicles accounting for the majority of those emissions. Recent initiatives under the Clean Air Act have improved emissions and fuel standards and established 377 emissions testing centers. With these efforts beginning to take hold, it is critical to continually improve the regulation of the 5.3 million registered vehicles in the country. The immediate challenges are to review and strengthen emissions standards for new and in-use vehicles, and to improve the quality and consistency of inspection procedures. Additionally, while the vehicle regulation system begins to take hold, other complementary mechanisms should be explored, including promoting natural gas vehicles; importing better used engines; supporting fuel maintenance programs; import duties on polluting vehicles and engines, and expanding the anti-smoke-belching program through the use of innovative technologies such as camera traps and cell phone text reporting the license plates of violators.

The Way Forward

The finalization of the National Environmental Health Action Plan provides both a conceptual framework and an important window of opportunity to take on the challenges of environmental health. Taking advantage of the strategic insight provided by the plan, government agencies can work together through the IACEH and independently under their respective mandates to achieve the targets and actions under the plan.

Box 7.1 What are your priority issues?

The Philippines Environment Monitor benefited from four consultation workshops throughout its preparation. The final workshop broke into five focus groups. They were asked to identify the priority issues that they would address. These were used as an input to the challenges.

Information Education and Advocacy: An information clearinghouse to provide reliable information and a mechanism to disseminate to local governments.

Infrastructure: Water resource development in urban areas through public/private partnerships and in rural areas through better local government capacity and financing. Better public awareness and regulation of septic tank maintenance and sanitation facility design and financial incentives for wastewater treatment.

Institutional and Cross-Sectoral Issues: Prioritizing environmental health in DOH plans and programs through strengthening the national and regional IACEH and local health boards and capacity building for DOH and LGUs.

Health Surveillance and Information: Providing an integrated surveillance, tracking and early warning system aligned to national targets that functions effectively, efficiently, and sustainably.

Regulation: Clarifying roles under the Clean Water Act and Sanitation Code and the role of LGUs as regulators and service providers. Improving enforcement of laws related to vehicle emissions, identifying alternatives to incinerators, and strengthening air quality monitoring.

Annex 1. METHODOLOGY

1. Data limitations and presentation

The analysis used available data and scientifi c information to assess the burden of disease for air pollution, water pollution, and sanitation and hygiene. The analysis considered the source and treatment of the data. In particular:

Morbidity data (disease cases) relied upon the Field Health Surveillance Information System (FHSIS), which provides data on cases reported by municipalities of the different disease cases found in their hospitals and clinics. It includes those cases where people visit the hospital and therefore does not include situations where the disease is either not severe enough to warrant a visit or where people just do not visit the doctor due to behavioral choices or access to the facility. It also suffers from variability of reporting among municipalities and provinces. Incidence fi gures and absolute number of cases should be read with this in mind. Recognizing these limitations, the report does not focus on the absolute numbers of cases, but rather, highlights the information provided on the proportion of cases of an individual disease or those attributed to environmental causes in relation to the total of all disease cases reported. This provides important information on the relative importance of a given disease or disease causes. Disparities in reporting practices across provinces and to a lesser extent, across regions, are also believed to affect the precision of the provincial differences in reported disease incidence. With this in mind, only the relatively large disparities found between provinces and regional data were emphasized in the discussion in the report. The economic analysis also considers the source and limitations of the data (see below).

Mortality data (disease cases) relied upon the National Statistics Offi ce data, which provides data on the causes of death reported as part of the vital statistics of the country. Reporting of deaths is more reliable than of disease cases due to the nature of the event, as well as the legal requirements associated with reporting. Under reporting due to lack of death certifi cates is relatively low, amounting to approximately 10 percent. The absolute numbers for mortality are highlighted in the report, along with the distribution relative to other reported causes of death.

2. Diseases attributable to environmental factors

Estimates of the environmental burden of disease were modeled after the analysis done by WHO (2006) in *Preventing Disease Through Healthy Environments*. The defi nition of environment used includes all physical, chemical, and biological factors external to the human host, and all related behaviors, but excluding those natural environments that cannot reasonably be modifi ed. The defi nition excludes behavior not related to the environment, as well as behavior related to the social and cultural environment, genetics, and parts of the natural environment. Using this as a basis, the fractions listed in Table A.1 represent the decline in the disease that could be achieved in a given population by reducing the environmental risk. The environment-related fraction was calculated by multiplying the attributable fraction for each disease by the reported cases of disease (Department of Health–National Epidemiology Center 2004a) and reported causes of death (Department of Health–National Epidemiology Center 2002).

Table A.1 Fraction of disease cases attributable to the environment for top ten causes of morbidity and mortality in the Philippines			
Disease	**Attributable fraction**	**Source**	**Notes**
Acute lower respiratory infections and Pneumonia	4 %	See Section 4	Calculated using global formulas applied to the Philippines
Cardiovascular diseases (including all heart diseases)	16 %	WHO, 2006b	Based on global data
Tuberculosis (including respiratory tuberculosis)	19 %	WHO, 2006b	Based on global data
Intestinal infectious disease	94 %	WHO, 2006b	Based on global data
Chronic lower respiratory disease (including chronic obstructive pulmonary disease and bronchitis)	42 %	WHO, 2006b	Based on global data
Malaria	50 %	WHO, 2006b	Regional (southeast asia) numbers
Dengue fever	95 %	WHO, 2006b	Based on global data
Nutritional deficiencies	50 %	WHO, 2006b	Based on global data
Lung cancer	17 %	WHO, 2006b	Based on global data
Transport accidents	42 %	WHO, 2006b	Based on global data

3. Water pollution and hygiene contribution to disease

Estimates of the contribution of the environment to disease were made for diseases for which data was available and that are categorized according to the Bradley classifi cation of disease as being caused by water pollution, poor sanitation and hygiene. The fraction of diseases attributable to environmental causes were based on international data applied to the Philippines based on expert judgment and scientific literature (Table A.2). The environment-related fraction was calculated by multiplying the attributable fraction for each disease by the cases of disease (Department of Health National Epidemiology Center 2004a) and causes of death (Department of Health National Epidemiology Center 2002).

Table A.2 Attributable fractions due to water pollution, sanitation and hygiene				
Disease	**Relationship to Pollution and Sanitation**	**Attributable Fraction**	**Sources**	**Notes**
Diarrhea	Fecal contamination due to domestic water pollution	88%	WHO, 2006b	Based on global data indicating that 88 percent is due to water and sanitation related issues
Helminthiasis	Transmitted via soil contaminated with fecal pollution due to domestic water pollution	100%	WHO, 2006b	Considered fully attributable to poor water and sanitation
Schistosomiasis	Transmitted through contact with water contaminated with human waste with eggs from host snail	100%	WHO, 2006b	Current understanding is that it is fully attributable to environmental risks
Typhoid and paratyphoid	Fecal contamination due to domestic water pollution	50%	Expert opinion of World Bank staff	
Cholera	Fecal contamination due to domestic water pollution	100%	Widely accepted	Known to be entirely attributable to poor sanitation conditions
Hepatitis A	Fecal contamination due to domestic water pollution	50%	Expert opinion of World Bank staff	
Filariasis	Two vectors in the Philippines breed in water that is polluted; Either dirty (*Culex*) and filled with aquatic weeds (*Monsania*)	20%	Expert opinion of World Bank staff	An estimate based on the fact that much of the filariasis is due to a mosquito vector that is associated with plantations, with only a fraction of those related to vectors that breed in polluted water
Nutritional deficiencies	Malnutrition increases as a result of the above diseases. It also increases the susceptibility to the above diseases.	50%	WHO, 2006b	Water and sanitation are the predominant environmental factor to which malnutrition is attributable.

4. Disease burden of outdoor air pollution

Disease attributable to outdoor air pollution was determined for those age groups for which a correlation between particulate matter concentration has been established based on scientifi c literature as outlined in *Environmental Burden of Disease Series No. 5* by Bart Ostro. This was done using data on particulate matter concentration and mortality and morbidity data of the relevant diseases from the Department of Health (FHSIS reports). The present data on particulate matter concentration suitable for long-term exposure assessment are limited. There were three data sources: (a) direct measurements of PM_{10} and $PM_{2.5}$ concentrations in some parts of Metro Manila from special studies, which also yielded ratios of $PM_{10}/PM_{2.5}$ (fractions of $PM_{2.5}$ in PM_{10} ranged from 68 to 81 percent, or an average of 76 percent); (b) roadside TSP measurements by DENR from fixed monitors in selected cities, including cities in Metro Manila and some urban towns (ratios of PM_{10} and TSP in few locations where DENR and ADB measurements coincided ranged from 32 to 60 percent, or an average of 46 percent); and (c) World Bank-WHO econometric model estimates of PM_{10} concentrations in Philippine cities with populations over 100,000. The concentrations used in the assessment and their bases are summarized in Table A.3.

Table A.3 Particulate matter concentrations used in the analysis				
Particulate matter concentration	**Metro Manila (National Capital Region)**		**Other urban areas (Cities)**	
PM_{10} (ug/m^3)	64	Average of actual measurements from ADB study (ADB, 2004) and 46% of TSP values from DENR's monitoring stations (NAQSR, 2002–03) and WHO-World Bank estimates.	43	Based on conversion of DENR TSP monitoring data (2002–03) to PM_{10} using average PM_{10}/TSP ratio and WHO-World Bank estimates.
$PM_{2.5}$ (ug/m^3)	50	Average of actual measurements from ADB Study (ADB, 2004) and values obtained as 76% (average ratio) of PM_{10}.	32	Based on conversion factor of 76% (average ratio) of PM_{10} to $PM_{2.5}$.
Note: Background values for PM_{10} and $PM_{2.5}$ of 15µg/m^3 and 7.5µg/m^3 respectively, are adopted from Ezzati *et al.* (2002).				

The fractions attributable to outdoor air pollution were calculated as: AF = (RR – 1)/(RR), where AF is the attributable fraction and RR is the relative risk of air pollution exposure. The formulas for RR are given in Table A.4, using as inputs actual and counterfactual or baseline PM_{10} and $PM_{2.5}$ concentrations.

Table A.4 Relative risks from exposure to outdoor air pollution	
Health Outcome	**Model**
Respiratory mortality (e.g. Acute Lower Respiratory Infections) among children <5 years old due to short term exposure to PM_{10}	$RR = \exp [0.0016*(PM_{10(actual)} - PM_{10(counterfactual)})]$
Cardiopulmonary mortality (e.g. COPD and cardiovascular diseases) among adults >30 years old due to long term exposure to $PM_{2.5}$	$RR = [(PM_{2.5(actual)} + 1) / (PM_{2.5\ (counterfactual)} + 1)]^{0.15515}$
Lung cancer mortality among adults >30 years old due to long term exposure to $PM_{2.5}$	$RR = [(PM_{2.5(actual)} + 1) / (PM_{2.5\ (counterfactual)} + 1)]^{0.23218}$

The resulting RR and AF values are presented in Table A.5. The disease burden is calculated as: E = AF x B x P, where E is the expected number of deaths due to exposure to air pollution, B is the incidence rate of deaths, and P is the relevant exposed population. The attributable fractions were used to calculate expected number of morbidity cases due to outdoor air pollution. National data on age and sex distribution of disease cases and mortality was used and assumed to be the same for Metro Manila, other cities, and the provinces.

Table A.5 Particulate matter concentrations used in the analysis				
Disease	**Metro Manila**		**Other Cities**	
	RR	**AF**	**RR**	**AF**
ALRI (<5 years old)	1.09	7.9%	1.05	4.5%
Cardiopulmonary (<5 years old)	1.32	24%	1.24	19%
Lung Cancer (>30 years old)	1.51	34%	1.37	27%

5. Disease Burden of Indoor Air Pollution

The assessment considers only exposure to solid fuel smoke, particularly exposure to fuelwood smoke from domestic cooking. The disease burden was determined following the method outlined in *Environmental Burden of Disease Series No. 4* by Desai Manish *et al.* (2002). The data on fuelwood use were obtained from National Census and Statistics Office (NSO). A global assessment by Smith *et al.* (2004) estimated household fuel use in 156 countries and puts the solid fuel use in the Philippines at 85 percent, with a ventilation coefficient of 1.00. Actual surveys on the ground revealed that many Philippine houses and kitchens are well-ventilated, and cooking outside the house is common in rural areas. Hence, following Desai Manish *et al.* (2002), a ventilation coefficient of 0.25 is used instead of 1.00. Philippine households rarely used coal, which is linked to lung cancer, for cooking. The 1995 Household Energy Consumption Survey (HECS) of the National Census Office (NSO) revealed that some 63.5 percent of Philippine households used fuelwood for cooking. The proportion is about 10 percent in Metro Manila and about 30 percent in other urban areas. The most recent HECS survey was conducted in October 2004, but only preliminary results have been published. Table A.6 shows the estimated proportions of households using fuelwood.

Table A.6 Fuelwood use in the Philippines as of 2004

Area	Proportion of households using fuelwood for cooking	Proportion adjusted by ventilation factor of 0.25	Basis
Countrywide	0.55	0.138	Preliminary result of the October 2004 HECS by the NSO estimates fuelwood using households has dropped to 55%
Metro Manila	0.088	0.022	10% estimate for Metro Manila from the 1995 HECS adjusted based on preliminary result of the 2004 survey
Other Urban Areas	0.28	0.071	1995 HECS estimate for urban areas adjusted based on the 2004 survey results
Rural Areas	0.87	0.216	1995 HECS estimate for rural areas adjusted based on the 2004 survey result

Following Desai Manish *et al.* (2002), the fractions of mortality and morbidity cases attributable to fuelwood smoke exposure for each disease were calculated as:

$$AF = (P*RR + -P) / (P*RR+ 1-P),$$

where RR is the relative risk obtained from epidemiological studies and P is the proportion of the population that are exposed to fuelwood smoke, adjusted for ventilation factor as estimated in Table A.5.

The disease burden is calculated as: E = AF x N, where N is the number of morbidity or mortality cases observed or reported on the relevant age group. National data on age and sex distribution of disease cases and mortality was used and assumed to be the same for Metro Manila, other cities, and the provinces.

Table A.7 Fractions of disease cases attributable to fuelwood smoke					
Health Outcome	Relative Risk*	Attributable Fractions (AF) (%)			
		Country	Metro Manila	Other Cities	Other Cities
ALRI Children aged <5	2.3	15	3	8	22
COPD Women aged >30	3.2	23	5	13	32
COPD Men aged >30	1.8	10	2	5	15
Lung Cancer Women aged >30	1.5	6	1	3	10
*Source of RR is WHO, Desai Manish *et al.* (2002)					

6. Economic costs

The economic cost estimates focus on the costs associated with treatment and hospitalization and the lost income associated with those visits for those people that reportedly visited the hospital and clinic. It also includes the loss of potential income due to premature death. It is considered a lower bound estimate due to (a) the likely gaps in reporting from municipalities and provinces through the FHSIS; (b) it does not consider other costs such as home treatment and the pain and suffering experienced due to medium- to long-term affliction with a disease; (c) it does not consider diseases where either good morbidity or mortality data was not available and also a good basis for estimating the fraction that is attributable to the environment. The most notable gaps are lung cancer and asthma morbidity; typhoid mortality, and morbidity due to nutritional defi ciencies.

Economic Costs of Premature Death. The economic cost of premature death is calculated as the present value of the forgone income stream (at a discount rate of 5 percent) of the remaining productive life, reckoned from the average age of death and the average life expectancy for Filipinos (70 years). The productive year of the person is assumed to begin at age 21. In calculating lost income, we used the average annual employee compensation of P38,000 from the Philippine National Income Account.

Economic Cost of Morbidity. The economic cost of morbidity includes direct costs (i.e., medical and hospitalization costs) and indirect cost (i.e. loss income due to reduced workdays). In terms of direct costs, it is assumed that all cases of morbidity result in some kind of medical treatment and hospitalization or at least a visit to a doctor or a medical clinic. Data on the average costs of medical treatment (i.e. average payments made on hospital bed, professional fees, medicine and hospital services) of various illnesses were obtained from Philhealth. The total direct cost of morbidity of a particular illness is estimated by multiplying the number of reported cases with the average medical costs incurred for the illness. In terms of indirect cost, it is assumed that each reported morbidity case results in a reduced number of workdays of at least one adult. If the sick person is a small child, it is assumed that one working adult would have to skip work. The average number of days of hospital confi nement per illness obtained from Philhealth provided an indicative estimate of the number of workdays lost. The average annual compensation obtained from the Philippine National Income Accounts divided by 250 workdays in a year provided an estimate of the lost income per day.

Annex 2. Useful Websites

Organization	Website Address	Description
Department of Environment and Natural Resources (DENR)	www.denr.gov.ph	Overview of the programs and projects that help protect, preserve, and enhance the natural resources of the Philippines
Environmental Management Bureau (EMB)	www.emb.gov.ph	Focuses on environmental laws for various environmental media, standards, and environmental quality status of the country
Department of Health (DOH)	www.doh.gov.ph	Programs and projects to improve health and sanitation
National Water Resources Board (NWRB)	www.nwrb.gov.ph	Water resource regions and water quantity and availability
Manila Observatory	www.observatory.ph	One of the objectives of this institution is to help measure pollutants; the site is currently under construction
Asian Development Bank (ADB)	www.adb.org	ADB environmental-health-related programs
Clean Air Initiative (The World Bank, ADB, and others)	www.worldbank.org/cleanair/caiasia/	Provides information on all topics under air quality management and also the linkages to various ongoing environment activities in the region; it has discussion space aimed to exchange ideas on various topics affecting the region
US - Asia Environmental Partnership (USAEP)	www.usaep.org	Links to recent development in environment and its own projects in the region
U.S. Environmental Protection Agency (USEPA)	www.epa.gov	Extensive information available on all technical and legal aspects of environment, including air, water and health
United Nations Development Program (UNDP)	www.undp.org	UNDP environmental-health-related programs
World Bank Water and Sanitation Program (WSP)	www.wsp.org	Description and details regarding the World Bank Water and Sanitation Program
World Health Organization (WHO)	www.who.int	Provides extensive information on all technical aspects of environmental health, including air pollution and WHO guidelines for various pollutants

Annex 3. REFERENCES

Aiga, H., T. Umenai. 2002. "Impact of improvement of water supply on household economy in squatter area of Manila." Social Science and Medicine 55 (4):627-641

Akagi, H., E.S. Castillo, N. Cortes-Maramba, A.T. Francisco-Rivera, and T.D.Timbang. 2000. "Health assessment for mercury exposure among schoolchildren residing near a gold processing and refining plant in Apokon, Tagum, Davao del Norte, Philippines." *Science of the Total Environment* 259:31–43

Alcala, Angel C. 1993. State of the Philippine Environment and Natural Resources. DENR Public Affairs Offi ce.

Appleton, J.D., J.M. Weeks, J.P.S. Calvez, and C. Beinhoff. 2006. "Impacts of mercury contaminated mining waste on soil quality, crops, bivalves, and fish in the Naboc River area, Mindanao, Philippines." *Science of the Total Environment* 354 (2/3):198-211

Asian Development Bank, World Health Organization-WPRO, and Department of Health. 2004. *Pubic Health Monitoring of the Metro Manila Air Quality Improvement Sector Development Program*.

Asian Development Bank (ADB). 2002. *Water for All*.

Asian Regional Research Programme on Environmental Technology. 2004. *Improving Air Quality in the Philippines*. Manila Observatory.

Belizario VY, A. Saul, M.D. Bustos, *et al*. 1997. "Field epidemiological studies on malaria in a low endemic area in the Philippines." *Acta Trop* 63:241-256

Bumatai, C. *Water Use in Metro Manila and Metro Cebu*. National Water Resources Board.

Castillo E., N.P. Cortes-Maramba, J.P. Reyes, I. Makalinao, C. Dioquino, A.T. Francisco-Rivera, R. Timbang, C. Boutron, C. Ferrari. 2003. "Health and environmental assessment of the impact of mine tailings spillage in the Philippines." *Journal de Physique* 107 (Part 1):275-279

Center for Disease Control (CDC) and World Health Organization (WHO). 2005. *Global Youth Tobacco Survey (GYTS)—Results from the Philippines 2000 and 2003*.

Cortes-Maramba N., H. Akagi, R. Sunio, L.C. Panganiban, J.P. Reyes, A.T. Francisco-Rivera. 2006. "Health and environmental assessment of mercury exposure in a gold mining community in Western Mindanao, Philippines." *Journal of Environmental Management Mercury cycling in contaminated tropical non-marine ecosystems* 81:126-134

Department of Environmental and Natural Resources–Environmental Management Bureau (DENR-EMB). 2003. *National Air Quality Status Report 2002*.

Department of Environmental and Natural Resources–Environmental Management Bureau (DENR-EMB). 2005a. *National Air Quality Status Report 2003–04*.

Department of Environmental and Natural Resources–Environmental Management Bureau (DENR-EMB). 2005b. *National Water Quality Status Report 2001–05*.

Department of Health (DOH). 2000. *Baseline Surveys for National Objectives for Health*.

Department of Health National Epidemiology Center (DOH-NEC). 2001. *Annual Report*.

Department of Health National Epidemiology Center (DOH-NEC). 2004a. *Field Health Service Information System*.

Department of Health National Epidemiology Center (DOH-NEC). 2004b. *Field Health Service Information System Annual Report 2004*.

Department of Science and Technology–Food and Nutrition Research Institute (DOST-FNRI). 2004, 2003–04. *National Nutrition and Health Survey*.

Esrey, S., J. Potash, L. Roberts, and C. Shiff. 1991. "Effects of Improved Water Supply and Sanitation on Ascariasis, Diarrhea, Dracunculiasis, Hookworm Infection, Schistosomiasis, and Trachoma." *WHO Bulletin* 69(5):609

Ezeamama, A., J. Friedman, L. Acosta, D. Bellinger, G. Langdon, D. Manalo, R. Olvida, J. Kurtis, and S. McGarvey. 2005. "Helminth Infection and Cognitive Impairment among Filipino Children." *American Journal of Tropical Medicine and Hygiene* 72(5):540–548

Furio, E., C. Gonzalez, and Y. Fukuyo. Widespread Outbreak of Toxic Red Tide in the Philippines. Available at: http://fol.fs.a.u-tokyo.ac.jp/rtw/TOP/EXabst/018ElsaFFurio.pdf.

GEF/UNDP/IMO and DENR. 2004. *Manila Bay: Refi ned Risk Assessment*

GEF/UNDP/IMO and DENR. 2006. *Initial Valuation of Selected Uses and Habitats and Damage Assessment in Manila Bay*.

Hutley, S., S. Morris, and V. Pisana. 1997. "Prevention of Diarrhea in Young Children in Developing Countries." *WHO Bulletin* 75(2):163

International Scientific Forum (ISF). 2004. "Home Hygiene in the Philippines: Breaking Barriers on Solid Ground." Roundtable Discussion, Manila, April 17, 2004.

Kim, B., M. Ock, D. Chung, T. Yong, K. Lee. 2003. "The intestinal parasite infection status of inhabitants in the Roxas City, the Philippines." *The Korean Journal of Parasitology* 41(2):113-115

Luby, S.P., M. Agboatwall, and D.R. Feikin, *et al.* 2005. "Effect of hand washing on child health: a randomized controlled trial." *Lancet* 366:225-33

Luby, S.P., M. Agboatwalla, J. Painter, A. Altaf, W.L. Billhimer, and R.M. Hoekstra. 2005. "Effect of intensive hand washing promotion on childhood diarrhea in high risk communities in Pakistan: a randomized controlled trial." *Journal of the American Medical Association* 291:254–54

Desai, M., S. Mehta, K. Smith. 2002. *Environmental Burden of Disease Series No. 4*. World Health Organization.

Maramba, N.P.C., L.C.R. Panganiban, C. Dioquino, N. Dando, R. Timbang, H. Akagi, M.T. Castillo, C. Quitoriano, M. Afuang, A. Matsuyama, T. Eguchi, Y. Fuchigami, J.P. Reyes, and A.T. Francisco-Rivera. "Environmental and human exposure assessment monitoring of communities near an abandoned mercury mine in the Philippines: A toxic legacy." *Journal of Environmental Management* 81(2):135–145

National Statistical Coordination Board (NSCB). 2005. *Philippine Statistical Yearbook*. Manila: NSCB.

National Statistics Offi ce (NSO). 1998.*National Demographic and Health Surveys*.

National Statistics Offi ce (NSO). 2000a.*Census of Population and Housing.*

National Statistics Offi ce (NSO). 2000b.*Mortality Statistics*.

National Statistics Offi ce (NSO). 2002.*Mortality Statistics*.

National Statistics Offi ce (NSO). 2003a.*Family Income and Expenditure Survey*.

National Statistics Offi ce (NSO). 2003b.*National Demographic and Health Surveys*.

National Statistics Offi ce (NSO). 2004.*Household Energy Consumption Survey*.

National Statistics Offi ce (NSO). 2006.*Tobacco and Poverty Study*.

Ostro B. 2004. *Environmental Burden of Disease Series No. 5*. World Health Organization.

Pedro, R. A., R.C. Benvides, and C.V.C. Barba. *Dietary Changes and Health Implications: An emerging double burden of under and over nutrition*.

Prüss-Üstün, A., and A. Corvalan. 2006. *Preventing Disease Through Healthy Environments: Toward an estimate of the environmental burden of disease*.

Rice, A.L., L. Sacco, A. Hyder, and R.E. Black. 2000. "Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries." *Bull World Health Organization* 78 (10):1207–1221

Smith, K.R., S. Mehta, and M. Feuz. 2004. 'Chapter 18: Indoor Smoke from Household Use of Solid Fuels.' In *Comparative Quantifi cation of Health Risks: The Global Burden of Disease Due to Selected Risk Factors*, ed. M. Ezzati, A. D. Lopez, A. Rodgers, and C. J. L. Murray, vol. 2, 1435-93.

Social Weather Station, World Bank. 2000. *Filipino Pro Poor Report Card*, 2000.

Subida, R.D., E.B. Torres. 1991. *Epidemiology of Chronic Respiratory Symptoms and Illnesses Among Jeepney Drivers, Air-conditioned Bus Drivers and Commuters in Metro Manila*. World Health Organization/College of Public Health University of the Philippines, Manila

Subida, R.D., E.B. Torres. 1994. *Impact of Vehicular Emissions on Vulnerable Populations in Metro Manila*. World Health Organization/College of Public Health University of the Philippines, Manila

Tauli-Corpuz, V. "The Marcopper Toxic Mine Disaster–Philippines' Biggest Industrial Accident." Available at: <http://www.twnside.org.sg/title/toxic-ch.htm>

UNICEF. 2006. *Progress for Children: A Report Card on Water and Sanitation*.

Water and Sanitation Program (WSP). 2006. *Rapid Assessment Case Study*.

World Bank. 2001. *Philippines Environment Monitor 2001*.

World Bank. 2003a. *Philippines Environment Monitor 2003: Water Quality*.

World Bank. 2003b. *Manila Third Sewerage Project Feasibility Study*.

World Bank. 2004. *Philippines Environment Monitor 2004: Assessing Progress*.

World Bank. 2005. *Meeting Infrastructure Challenges*.

Department of Energy. 2004. *Philippines Household Energy Survey*.

World Health Organization (WHO). 2005. *Health Effects of Transport Related Air Pollution*.

World Health Organization (WHO). 2006a. *Air Quality Guidelines for particulate matter, ozone, nitrogen dioxide, and sulfur dioxide: Global Update 2005*

World Health Organization (WHO). 2006b. *Preventing Disease Through Healthy Environments*.

World Health Organization and UNICEF. 2006. *Water Coverage Estimates*. Joint Monitoring Program for Water Supply and Sanitation. Available at: http://www.wssinfo.org/en/welcome.html

Yoon, P.W., R.E. Black, L.H. Moulton, and S. Becker. 2000. "The effect of Malnutrition on the risk of diarrheal and respiratory mortality in children<2 yrs of age in Cebu, Philippines." *American Journal of Clinical Nutrition* 65:1070–1077

Annex 4. PHILIPPINES AT A GLANCE

GEOGRAPHY	
Area: *Total*	300,000 sq. km
Land	298,170 sq. km
Water	1,830,830 sq. km
Boundaries:	
North:	Balintang Channel
South:	Sulu and Celebes Seas
East:	Philippine Sea/Pacific Ocean
West:	South China Sea
Coastline	17,460 km
Maritime claims:	
Total territorial water area incl. Exclusive Economic Zone	2,200,000 sq. km
Coastal	266,000 sq. km
Oceanic	1,934,000 sq. km
Continental shelf area	184,600 sq. km
Climate: Tropical: northeast monsoon (Nov. to April); southwest monsoon (May to October)	
Terrain: Mostly mountains, with narrow to extensive coastal lowlands	
Elevation extremes:	
Lowest point	Philippine Sea 0 m
Highest point	Mt. Apo 2,954 m
Natural resources: timber, nickel, cobalt, silver, gold, salt, copper, petroleum	
Land use:	
Arable land	19%
Permanent pastures	4%
Permanent crops	12%
Forest & wetlands	46%
Others	19%
Environment – International agreements:	
Party to: Climate Change, Endangered Species, Hazardous Wastes, Marine Dumping, Nuclear Test Ban, Ozone Layer Protection, Biodiversity, Wetlands, Whaling, POPs	

ECONOMY / SOCIETY	
GDP (2005)	5,379 B
GDP growth rate (2005)	5.1%
GDP – composition by sector:	
Agriculture	14%
Industry	33%
Services	53%
Unemployment rate (2005)	10.3%
Gross Domestic Investment/GDP	15.7%
Exports of goods and services/GDP	46.4%
Gross domestic savings/GDP	19.5%
Gross national savings/GDP	18.2%
Industrial production growth rate	5.3%
Agricultural production growth rate	2.0%
Agriculture – products: rice, coconut, corn, sugarcane, banana, hog, broiler chicken, layer chicken, carabao, beef cattle, dairy cattle, duck, goat, chicken eggs, duck sardines, milkfish, oyster, mussels, tilapia, catfish	
Exports (2005)	PHP2,496 B
Imports (2005)	PHP2,533 B
Exchange Rate	PHP56.04
Population (2005)	85.2 million
Population growth rate	2.2%
Urban population (% of total)	62.6
Access to safe water (% of population 2004)	85%**
Access to sanitation (% of population 2004)	72%**
Life expectancy at birth (2003)	69.8 years
Literacy (total population 2003)	92.3%
Elementary participation rate (2003)	90.1%
National capital: Manila	
Administrative divisions (July 2004): 17 regions, 79 provinces	
Independence: June 12, 1898	