

The World Health Organization's

INFORMATION SERIES ON SCHOOL HEALTH DOCUMENT 2

The Physical School Environment

An Essential Component of a Health-Promoting School

This document is a joint effort of the Department of Protection of the Human Environment and the Department of Noncommunicable Disease Prevention and Health Promotion.

It is jointly published with partner organizations working together in the international initiative to Focus Resources on Effective School Health (FRESH). It is also intended to support the objectives of the Healthy Environments for Children Alliance.



WHO



UNICEF



WORLD BANK



Education International
Internationale de l'Éducation
Internacional de la Educación
Bildungsinternationale

The principles and policies of each of the above agencies are governed by the relevant decisions of its governing body and each agency implements the interventions described in this document in accordance with these principles and policies and within the scope of its mandate.

www.caryp.mobi

ACKNOWLEDGEMENTS	iv
FOREWORD	v
1. INTRODUCTION	1
1.1 Why did WHO prepare this document?	1
1.2 Who should read this document?	1
1.3 What is a healthy physical school environment?	1
1.4 Why increase efforts to improve the physical environment at schools?	3
1.5 Why focus efforts through schools?	3
1.6 How will this document help people recognize threats and take control over and improve their environment?	4
2. CONVINCING OTHERS THAT SCHOOLS' PHYSICAL ENVIRONMENT IS IMPORTANT	5
2.1 Argument: Many childhood illnesses and deaths are greatly influenced by the environment	5
2.1.1 Respiratory infections	6
2.1.2 Diarrhoeal diseases	7
2.1.3 Vector-borne diseases	7
2.1.4 Injuries and poisonings	8
2.1.5 Cancer	9
2.1.6 Developmental disabilities	9
2.1.7 Asthma	10
2.2 Argument: Children are more susceptible to environmental diseases than adults and therefore need healthy school environments	11
2.2.1 Water and sanitation	12
2.2.2 Indoor air pollutants	13
2.2.3 Outdoor air pollutants	14
2.2.4 Ultraviolet radiation	14
2.2.5 Pesticides	14
2.2.6 Food	15
2.2.7 Hazardous location	16
2.3 Argument: Implementing changes in the school's physical environment can improve children's health	16
3. CONVINCING OTHERS THAT IMPROVING THE PHYSICAL SCHOOL ENVIRONMENT WILL PROTECT HEALTH	17
3.1 Argument: Children's health can improve with low-cost interventions to the physical environment at schools	17
3.2 Argument: Improvements in the physical environment at schools can increase school attendance	18

4. PLANNING INTERVENTIONS FOR HEALTH PROTECTION IN SCHOOL ENVIRONMENTS	19
4.1 Procedural steps toward creating a healthy physical environment at schools	19
4.2 Goals identification	19
4.2.1 Substantive goals	20
4.2.2 Procedural goals	20
4.3 Participation in planning the interventions	21
4.3.1 Form a school health team	21
4.3.2 Establish a community advisory committee	21
4.4 Intervention plans	22
4.4.1 Identify information needs	22
4.4.2 Answer basic questions and identify key information sources	24
4.5 Commitment and policies	24
4.5.1 Gain national political commitment	24
4.5.2 Achieve community commitment	25
5. INTEGRATING ENVIRONMENTAL HEALTH INTERVENTIONS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL	26
5.1 Skills-based health education	26
5.1.1 Methods and materials for skills-based health education in relation to the environment	27
5.1.2 Training teachers to implement skills-based health education in relation to the environment	28
5.1.3 The student's role in skills-based health education in relation to the environment	28
5.2 A healthy school environment	30
5.2.1 A safe school location and structure	30
5.2.2 Indoor school environment	31
5.2.3 Outdoor school environment	34
5.2.4 Healthy environmental management practices	35
5.3 School health services	40
5.4 Community and family projects and outreach	40
5.5 Health promotion for school staff	40
6. EVALUATION	41
6.1 Components of evaluations	41
6.2 Reporting progress and achievements	42
ANNEX 1: EXAMPLES OF EDUCATIONAL STRATEGIES TO PROMOTE ENVIRONMENTAL HEALTH	43
REFERENCES	46

This document was prepared for the World Health Organization (WHO) by John Wargo, Yale University, New Haven Connecticut.

Eva A. Rehfuss, Department of Protection of the Human Environment, WHO, and Jack T. Jones and Charles W. Gollmar, Department of Noncommunicable Disease Prevention and Health Promotion, WHO guided the overall development and completion of this document. Technical editing was undertaken by Martha Shimkin, and Caron Gibson, and copy editing by Karina Wolbang.

This paper draws on a variety of sources in the research literature and on consultation with experts working in the area of school health and environmental health. We wish to thank the following organizations and persons for their technical guidance, inspiration and generosity:

Monika Arora, HRIDAY-SHAN, India

Marie Louise Bistrup, International Research and Information Network on Children's Health, Environment and Safety

Amaya Gillespie, Senior Advisor, Education Sector, UNICEF

Jose Hueb, Protection of the Human Environment, WHO

Richard Helmer, Protection of the Human Environment, WHO

Kate Joicey, Gesellschaft für Technische Zusammenarbeit, Indonesia

Jenny Pronczuk, Protection of the Human Environment, WHO

Yasmin von Schirnding, Healthy Environments for Children Alliance, WHO

Merri Weinger, Environmental Health Technical Advisor, USAID

National Council on Education, Uruguay

"The children of today are the adults of tomorrow. They deserve to inherit a safer and healthier world. There is no task more important than safeguarding their environment." This message is emphasized by the Healthy Environments for Children Alliance (HECA), which focuses attention on the school environment as one of the key settings for promoting children's environmental health. HECA was launched at the 2002 World Summit on Sustainable Development. This publication is intended as a tool to help schools shape healthy environments for children.

The Physical School Environment: An Essential Component of a Health-Promoting School focuses on the physical environment of the school and is complemented by the document *Creating an Environment for Social and Emotional Well-being: An Important Responsibility of a Health-Promoting and Child-Friendly School*. Together, these two resources can help schools provide an environment that is supportive of the World Health Organization's definition of health, "... a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

The Physical School Environment: An Essential Component of a Health-Promoting School includes information to create a healthy school environment, and to identify and modify aspects of the physical environment that jeopardize safety and health. However, physical interventions alone will not suffice. The document also contains guidance to ensure that positive changes in a school's physical environment are supported, reinforced and sustained by school health policy, skills-based health education and school health services, the core components of an effective school health programme as called for in the international initiative to Focus Resources on Effective School Health (FRESH).

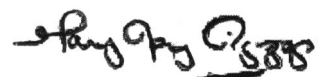
The extent to which each nation's schools provide a safe and healthy physical environment plays a significant role in determining whether the next generation is educated and healthy. Effective school health programmes, including a safe and healthy school environment, are viable means to simultaneously address the inseparable goals of Health for All and Education for All.



Pekka Puska
Director, Noncommunicable Disease
Prevention and Health Promotion
WHO, Geneva, SWITZERLAND



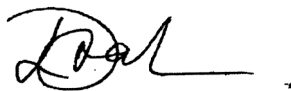
Maged Younes
Senior Advisor, Health and
Environment Coordinator,
Occupational and Environmental
Health,
WHO, Geneva, SWITZERLAND



Mary Joy Pigozzi
Director, Division for the Promotion
of Quality Education
UNESCO, Paris, FRANCE



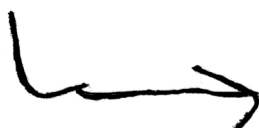
Cream Wright
Chief, Education Section
UNICEF, New York, USA



Leslie Drake
Coordinator, Partnership for Child
Development
London, UNITED KINGDOM



Cheryl Vince-Whitman
Director, WHO Collaborating Center to
Promote Health through Schools and
Communities
Education Development Center, Inc.
Newton, Massachusetts, USA



Fred Van Leeuwen
General Secretary
Education International
Brussels, BELGIUM

1. Introduction

Environmental challenges and opportunities vary considerably among schools around the world, across countries and within communities. Similarly, the resources available to schools to manage health hazards vary as widely as the threats themselves, often creating formidable management challenges, particularly in the poorest parts of the world. Evolving from recommendations of the Ottawa Charter for Health Promotion, *The Physical School Environment: An Essential Component of a Health-Promoting School* discusses a range of environmental conditions that exist in a variety of school environments. It presents strategies to improve the health, education and development of children, families, and community members and aims to help communities recognize, manage, and avoid physical, chemical and biological threats that may exist in or near their schools.^{1,2}

1.1 Why did WHO prepare this document?

The World Health Organization (WHO) prepared this document to help individuals, communities, school officials, and governments improve the health of children by reducing their exposure to environmental hazards. This will be accomplished by providing information to help people understand the relationship between the environment and health, identify key hazards in the places where children learn, and recognize children's special vulnerability and exposure to environmental threats. By taking action, health-promoting schools will send messages home to families and communities, encouraging awareness, and building skills to last a lifetime so that protecting children from environmental hazards becomes a way of life.

1.2 Who should read this document?

This document can be useful to:

- Members of the school community, including teachers and their representative organizations, administrative staff, students, parents, school facility managers, and school construction workers.
- Community leaders, local residents, health care providers, and other groups interested in improving public health.
- Members of non-governmental agencies, institutions, and organizations interested in working with schools to promote health.
- Government officials, policy-makers, decision-makers, planners and coordinators at local, district, provincial, national and international levels.

1.3 What is a healthy physical school environment?

The physical school environment encompasses the school building and all its contents including physical structures, infrastructure, furniture, and the use and presence of chemicals and biological agents; the site on which a school is located; and the surrounding environment including the air, water, and materials with which children may come into contact, as well as nearby land uses, roadways and other hazards.

WHO defines a health-promoting school as “one that constantly strengthens its capacity as a healthy setting for living, learning and working.”³ The American Academy of Pediatrics defines a “healthful school environment” as “one that protects students and staff against immediate injury or disease and promotes prevention activities and attitudes against known risk factors that might lead to future disease or disability.”⁴

Provision of safe and sufficient water, sanitation, and shelter from the elements are basic necessities for a healthy physical learning environment. Equally important is the protection from biological, physical, and chemical risks that can threaten children’s health (see Table 1). Infectious diseases carried by water, and physical hazards associated with poor construction and maintenance practices are examples of risks children and school personnel face at schools throughout the world.

Table 1: Components of a healthy school environment

Provision of basic necessities	<ul style="list-style-type: none"> • Shelter • Warmth • Water • Food • Light • Ventilation • Sanitary facilities • Emergency medical care
Protection from biological threats	<ul style="list-style-type: none"> • Molds • Unsafe or insufficient water • Unsafe food • Vector-borne diseases • Venomous animals • Rodents and hazardous insects • Other animals (e.g. dogs)
Protection from physical threats	<ul style="list-style-type: none"> • Traffic and transport • Violence and crime • Injuries • Extreme heat and cold • Radiation
Protection from chemical threats	<ul style="list-style-type: none"> • Air pollution • Water pollution • Pesticides • Hazardous waste • Hazardous materials and finishes • Asbestos, paint • Cleaning agents

1.4 Why increase efforts to improve the physical environment at schools?

The physical school environment has a strong influence on children's health for several reasons. First, the environment is one of the primary determinants of children's health: contaminated water supplies can result in diarrhoeal disease; air pollution can worsen acute respiratory infections and trigger asthma attacks; and exposure to lead, arsenic, solvents, and pesticides can cause a variety of health effects and even death.

Second, children may be more susceptible to the adverse health effects of chemical, physical, and biological hazards than adults. Reduced immunity, immaturity of organs and functions, and rapid growth and development can make children more vulnerable to the toxic effects of environmental hazards than adults. Relative to their body weight, they breathe more air, consume more food and drink more water than adults. Their exposure to any contaminant in air, water, or food will therefore be higher than experienced by adults. Children spend much of their day within school environments during critical developmental stages.

Third, children's behavioural patterns are distinctively different from adults and place them at risk from exposure to environmental threats that adults may not face. These behaviours include placing fingers and other objects in the mouth and not washing hands before eating. Children lack the experience to judge risks associated with their behaviours. Adolescents, in particular, are more likely to take risks, such as climbing and jumping from unstable structures.

1.5 Why focus efforts through schools?

Most children throughout the world attend primary school. It is important to the health of these children that they have clean water to drink, enough water to use for hygiene, adequate sanitation facilities, clean air to breathe, safe and nutritious food, and a safe place to learn and play. A contaminated environment can cause or exacerbate health problems. These include short-term health effects such as infectious diseases, respiratory infections or asthma that can reduce school attendance and learning ability. Health effects such as cancer or neurological diseases may be delayed until much later in life.

A healthy school environment can directly improve children's health and effective learning and thereby contribute to the development of healthy adults as skilled and productive members of society. Furthermore, schools act as an example for the community. Students, school employees, families, and community members should all learn to recognize environmental health threats that may be present in schools and homes. As members of the school community become aware of environmental risks at school they will recognize ways to make home and community environments safer. In addition, students who learn about the link between the environment and health will be able to recognize and reduce health threats in their own homes.

1.6 How will this document help people recognize threats and take control over and improve their environment?

This document provides information that can be used to recognize and reduce environmental health threats at school, striving to implement calls for the socio-ecological approach to health of the Ottawa Charter. It invokes the overall guiding principle of the Charter: to encourage reciprocal maintenance - to take care of each other, our communities and our natural environment.⁵ It also provides guidance that can lead to improved health and environmental protection. It will help schools, communities and governments:

- **Create health-protective public policy:** This document provides information that could guide adoption of public policy to improve the physical environment of schools and the overall health of children.
- **Develop supportive environments:** Simple, low-cost changes are suggested that could be made in school facilities and management to create a healthier environment for children to grow and thrive.
- **Reorient health services:** School administrators, teachers, and health care providers may recognize health problems in their school environment that are caused or exacerbated by these conditions.
- **Develop personal skills:** Information is provided to help students and staff recognize health threats and identify ways to reduce these hazards.
- **Mobilize community action:** This document identifies actions that could be taken by the school and community together to promote a healthy physical environment. It also describes ways in which the school can work with the community to implement and strengthen school health programmes. In addition, it fosters participation by students themselves to plan and work together with school and community representatives, drawing upon their local knowledge and ensuring consideration of their preferences and opinions to implement the most feasible, effective and sustainable environmental improvements.

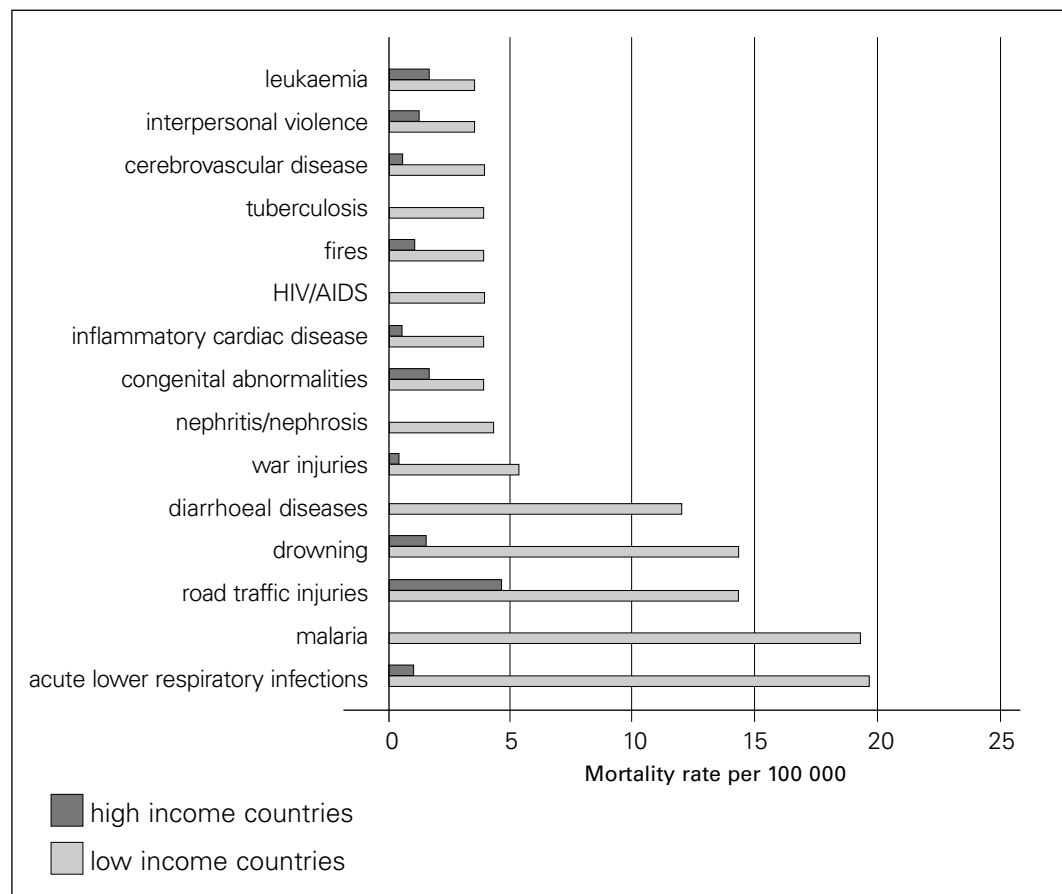
2. Convincing others that schools' physical environment is important

This section provides information that can be used to demonstrate the importance of creating and maintaining a healthy physical school environment to protect the health of children and others who spend time in schools. Some health and contamination problems relate to general levels of prosperity, other health threats may only exist in certain climates or geographical locations. Whatever the risk, children throughout the world are particularly vulnerable to environmental health threats. It is therefore important for educators, planners, and school administrators to be aware of specific health threats in their own school environments. Environmental health issues facing children in developing and developed countries throughout the world are discussed in the subsections below.

2.1 Argument: Many childhood illnesses and deaths are greatly influenced by the environment

Leading causes of mortality in school children aged 5 to 14 years for both low and high income countries are depicted in Figure 1.⁶ The higher rate of mortality in lower income countries is primarily due to the high incidence of acute respiratory infections, malaria, diarrhoeal diseases and injuries due to road traffic and drowning. Injuries are also dominant causes of death in higher income countries along with congenital abnormalities and leukaemia.

Figure 1: Leading causes of mortality in children aged 5-14 years, 2000



WHO estimates that between 25% and 33% of the global burden of disease can be attributed to environmental risk factors. About 40% of the total burden of disease due to environmental risks falls on children under the age of 5.⁷

Disease burden can be expressed in *Disability-Adjusted Life Years* (DALY), which combines the burden due to death and disability in a single index. The DALY index allows comparison of the impact of different diseases, and the contribution of environmental and other risk factors to these diseases. Table 2 presents the estimated contribution of selected environmental risk factors to major diseases in less developed and more developed countries.⁸

Table 2: Attributable DALYs by level of development (in thousands)⁹

Risk factor	Example of disease	High mortality developing countries	Low mortality developing countries	Developed countries
Unsafe water, sanitation and hygiene	Diarrhoeal diseases	46 183	7 150	825
Urban air pollution	Respiratory infections	2 685	4 008	1 171
Indoor smoke from solid fuels	Lower respiratory infections, lung cancers	30 393	7 595	550
Lead exposure	Cerebrovascular disease, hypertensive disease	5 953	5 584	1 388
Climate change	Diarrhoeal diseases, malaria, unintentional injuries	5 202	294	22

While this table represents the global burden of disease in all age groups one can surmise the relative effects of environmental exposures in children. It is important to remember that children are affected disproportionately by environmental exposures as compared to adults. Unfortunately, more specific data on the environmental burden of disease in children or on additional environmental risks are currently not available. WHO and UNICEF are co-leading a Global Initiative on Children's Environmental Health Indicators, launched at the World Summit on Sustainable Development, which intends to provide richer data on children's health and the environment in the near future.

Preventing childhood exposure to environmental hazards may prevent injuries, immediate illnesses, such as respiratory infections and diarrhoeal diseases, and diseases with longer latency periods, such as cancer, as discussed in detail below.

2.1.1 Respiratory infections

Respiratory infections are the most common among all diseases in children, and pneumonia is the primary cause of childhood mortality worldwide. Indoor and outdoor air pollution may be to blame for as much as 60% of the global burden of disease brought about by respiratory infections.¹⁰

The most recent estimates suggest that 36% of acute lower respiratory infections, including pneumonia, are attributable to solid fuel use.¹¹ More than half of the world's

2. CONVINCING OTHERS THAT SCHOOLS' PHYSICAL ENVIRONMENT IS IMPORTANT

population relies on solid fuels such as dung, wood and coal for cooking and heating needs, leading to very high levels of indoor air pollution. Exposure to such indoor air pollution has been linked with respiratory infections in children, chronic illness such as bronchitis and, in the case of coal, lung cancer in adults, and may be associated with low birth weight, tuberculosis, cataract, and many other diseases. Indoor air pollution is the fourth most important risk factor in developing countries (behind malnutrition, unsafe sex, and unsafe water and sanitation).

Outdoor air pollution remains a serious threat to health in cities throughout the world.¹² In Latin America, for example, air pollution limits are routinely exceeded in many cities including Sao Paulo and Rio de Janeiro, Brazil; Santiago, Chile; and Mexico City, Mexico.¹³ Both ambient air quality and a school's indoor air quality affect the respiratory health of school children.

2.1.2 Diarrhoeal diseases

Diarrhoeal diseases, the second most common global illness affecting young children and a major cause of death in lower income countries, are closely linked with poor sanitation, poor hygiene, and lack of access to safe and sufficient supplies of water and food. Each year, nearly two million children under the age of five die of diarrhoeal diseases caused by unsafe water supplies, sanitation, and hygiene. Interventions such as simple hand washing have been shown to reduce sickness from diarrhoeal diseases by up to 47%, and could save up to one million lives.¹⁴

Although diarrhoeal diseases are most prevalent in the developing world, they are also a significant health threat in developed countries. *Salmonella* and *Campylobacter jejuni*, tiny organisms that spread through eggs, chicken or milk, are two of the most common causes of diarrhoea in the developed world.¹⁵ Outbreaks of food poisoning in the United States of America, Canada, Europe, and Japan have been linked with the parasite *Cyclospora* and a new form of *E. coli* bacteria.¹⁶ Contaminated water can also be a cause of diarrhoea in the developed world. The largest outbreak of diarrhoea in the United States affected over 400 000 people when the municipal water supply of Milwaukee, Wisconsin was contaminated with *Cryptosporidium*, a parasite from farm animal waste.¹⁷ School children everywhere need to have access to safe and sufficient water and sanitation and need to be taught basic hygiene.

2.1.3 Vector-borne diseases

Vectors are organisms that transmit diseases and include mosquitoes, ticks, flies, fleas, triatomine bugs, worms, and rodents. Different species of mosquitoes can transmit different diseases such as malaria, dengue fever, yellow fever, lymphatic filariasis (known for its most dramatic symptom: elephantiasis), and Japanese encephalitis. Ticks can transmit Lyme disease, tick-borne encephalitis, relapsing fever, and many other illnesses. Rodents are capable of spreading the plague (transmitted from rats to humans by fleas), and other infectious diseases. In sub-Saharan Africa, tsetse flies can cause African trypanosomiasis (sleeping sickness).¹⁸ In Central and South America, triatomine bugs transmit American trypanosomiasis (Chagas disease).

Malaria, the most deadly of mosquito-transmitted diseases, kills over one million people each year; the majority of these deaths occur in African children under five.¹⁹ In endemic areas, 60% of all school children may suffer from malaria.²⁰ Controlling malaria requires

understanding the reproductive ecology, biology and behavioural patterns of mosquitoes. Nearly 60 mosquito species transmit malaria and different species have different ecological requirements in terms of altitude, rainfall, temperature, sunlight, humidity, heat, quality of available surface water, and host species. Culturally determined behaviours and environmental factors are key determinants of the increase in malaria in many parts of the world. For example, in hot periods, people may choose to sleep outside rather than in their houses, unprotected by bed nets or by the effects of indoor residual insecticide spraying. Standing water and poor waste management in schools increase the risk of vectors breeding and spreading near the school environment.

Another mosquito species can carry dengue and yellow fever and thrive in urban settings, where they lay their eggs in water storage containers or in discarded plastic bottles or tires. Since the 1960s, the incidence of dengue and dengue haemorrhagic fever has increased dramatically; about 20 million cases are estimated to occur each year.²¹ It is believed that rapid urbanization, the wide use of non-biodegradable plastic packaging and cellophane, increased travel and trade, and the lack of adequate mosquito control efforts have contributed to the increased incidence of this disease.²²

Schools sited adjacent to pools of water and wetlands are more susceptible to mosquito-borne diseases. Agricultural irrigation and forestry practices near schools may provide breeding places for disease-bearing mosquitoes. Children must be protected from disease vectors at home and at school. At the same time, learning to take precautions that help avoid contact with disease vectors can influence practices by families and in communities.

2.1.4 Injuries and poisonings

In high income countries, road traffic injuries are the most common cause of death among children aged 5 to 14, and account for approximately 10% of deaths in this age group. In low and middle income countries they are the fifth leading cause of death in the same age group behind diarrhoeal diseases, lower respiratory infections, measles and drowning.²³ Schools located near busy roads or water bodies have increased risks of these types of injuries. Falls and injuries within the school grounds can occur as a result of poorly maintained schools or poor construction management.

Poisonings in children account for about 2% of all injury deaths in children in developed countries, and about 5% in developing countries.²⁴ There is potential for children to be poisoned at school by pesticides due to improper storage or improper pesticide applications (see Box 1); lead in paint chips and in water contaminated by metals; and by chemicals in cleaning products. In addition, the effects of long-term exposure on children's health and development, even to low levels of pesticides, are suspected of having lasting effects that could extend over a lifetime.

Box 1: Pesticide poisoning in Peru ²⁵

In 1999, 24 children in the Peruvian Andes died and 18 more were severely poisoned by a powdered milk substitute that had been contaminated with the pesticide methyl parathion. Methyl parathion is classified as "extremely hazardous" and acutely toxic and is responsible for a large share of pesticide poisonings in Latin America. The pesticide was packaged in the form of a white powder that resembled powdered milk, had no strong chemical odour, and was stored in small plastic bags with no pictograms indicating danger or toxicity.

2.1.5 Cancer

Cancers of all types claimed more than 7 million lives in 2001.²⁶ This figure is likely to underestimate incidence, since disease surveillance efforts are often inadequate or non-existent. Genetic factors in combination with a wealth of environmental factors, such as exposure to chemical pollutants, and behavioural factors, such as unhealthy lifestyles, are believed to cause the vast majority of cancers.²⁷ Some environmental causes of childhood cancer such as ionizing radiation are well known.^{28 29} Other childhood exposures, such as excessive exposure to sunlight and environmental tobacco smoke, pesticides, solvents, radon (a radioactive gas) and arsenic may contribute to cancers that develop in adulthood.³⁰

³¹ All children are exposed to ultraviolet radiation from the sun and almost half of the world's children are regularly exposed to environmental tobacco smoke.³² Some evidence

Box 2: Exposures associated with the risk of childhood cancer in the school environment

- Pesticides
- Ultraviolet radiation (from the sun)
- Metals
- Paints
- Solvents
- Environmental tobacco smoke
- Radon

suggests that childhood cancer may be associated with a variety of other products and exposures (see Box 2).^{33 34} Children may be at higher risk of developing cancer due to some exposures, such as radiation and pesticides, than similarly exposed adults.³⁵ Therefore, it is important to minimize children's exposure to such agents in the school environment.

2.1.6 Developmental disabilities

Developmental disabilities include a variety of conditions that occur during childhood and cause mental or physical limitations. These disabilities include autism, cerebral palsy, epilepsy, mental retardation, and other neurological impairments. Many researchers believe an epidemic of learning and behavioural disabilities is occurring among children. Developmental disabilities are believed to be a significant and frequently undetected health problem in developing countries.³⁶ Malnutrition and parasitosis (especially helminth infections) may contribute to these illnesses.³⁷ In India, undernourished rural children 10-12 years of age demonstrated a range of learning deficiencies when compared to normally nourished children.³⁸ Considering the estimate that a third of the world's children suffered from malnutrition during the 1990s³⁹, the potential for widespread learning deficiencies is staggering. Schools could play an important role in ensuring that students have nutritious food to eat several times per day. Schools that offer a lunch programme give children an opportunity for at least one safe and nutritious meal a day. This also serves as a motivation for families to send children to school.

Exposure to toxic substances also places children at risk of developmental disorders, particularly in developing countries where regulations are lax or non-existent. In many developing countries where leaded gasoline is still used, lead presents a threat to more than half of urban children.⁴⁰ Populations in at least 100 countries are still exposed to air polluted with lead from gasoline.⁴¹ Also, past use of leaded gasoline in countries that have already phased out leaded gasoline leaves behind a reservoir of lead in the soil which will continue to pose a hazard to human health for years to come.⁴²

In the United States, 17% of children younger than 18 years have been diagnosed with one or more developmental disability.⁴³ It has been estimated that 25% of major developmental deficits may result from a combination of environmental and genetic

factors.⁴⁴ These estimates are based on known toxic substances. Since little is known about the developmental effects of most chemicals, this percentage could be much higher. Exposure to lead⁴⁵, mercury⁴⁶, organic solvents⁴⁷, substances such as polychlorinated biphenyls (PCBs)⁴⁸, and pesticides⁴⁹ (particularly organic compounds such as organophosphates⁵⁰) occur worldwide. All of these chemicals are known to affect the nervous system and are particularly harmful to children. Schools need to reduce or eliminate student exposures to these chemicals.

2.1.7 Asthma

Asthma and chronic respiratory illnesses such as bronchitis are growing problems, especially in intensively developed nations. Since the middle of the 20th century, the worldwide prevalence and severity of asthma have increased considerably, especially among children.⁵¹ In Taiwan, the prevalence of childhood asthma has risen to around 10% in contrast to a 1% prevalence rate in the 1970s.⁵² Currently, Australia and New Zealand report the highest asthma prevalence rates in the world (>15%), and in the United States, asthma is now the most prevalent chronic disease among children, affecting about 7% of all American children.⁵³ Between 1980 and 1995, the asthma prevalence rate for children increased 75% in the United States.⁵⁴ Asthma rates are increasing among all ethnic groups, both sexes, all age groups, and in all regions of the United States but asthma prevalence is highest among urban children^{55 56} and is the primary cause for childhood hospitalization in urban areas.⁵⁷

Experts acknowledge that in conjunction with genetic susceptibility, indoor and outdoor air pollution are an important factor in the increasing incidence and severity of asthma. Exposure to house dust mite allergens and secondhand smoke has been associated with the development of asthma as well as the exacerbation of asthma symptoms. Other indoor asthma triggers include allergens from cockroach, pet dander, and mold. Recently, ozone has been implicated as a factor contributing to asthma among children who exercise in urban settings. Common asthma triggers are listed in Table 3. By reducing exposure to allergens and irritants, the incidence of asthma attacks can often be reduced.

Table 3: Common asthma triggers⁵⁸

Allergic asthma	Non-allergic asthma
<ul style="list-style-type: none"> • House dust mites • Mold or yeast spores • Pollen • Cat hair, saliva, and urine • Cockroach particles • Aspirin or other nonsteroidal anti-inflammatory drugs • Metabisulfite, used as a preservative in many beverages and some foods 	<ul style="list-style-type: none"> • Tobacco smoke • Pollutants • Natural gas, propane, or kerosene used for cooking and heating • Wood smoke • Coal smoke • Paint fumes • Viral respiratory infections • Exercise

Schools represent an important setting for effective control measures. Wood smoke, environmental tobacco smoke, molds, and many volatile chemicals found in indoor environments can reduce respiratory function in school children. School absenteeism associated with these respiratory diseases can adversely affect both intellectual and emotional development.

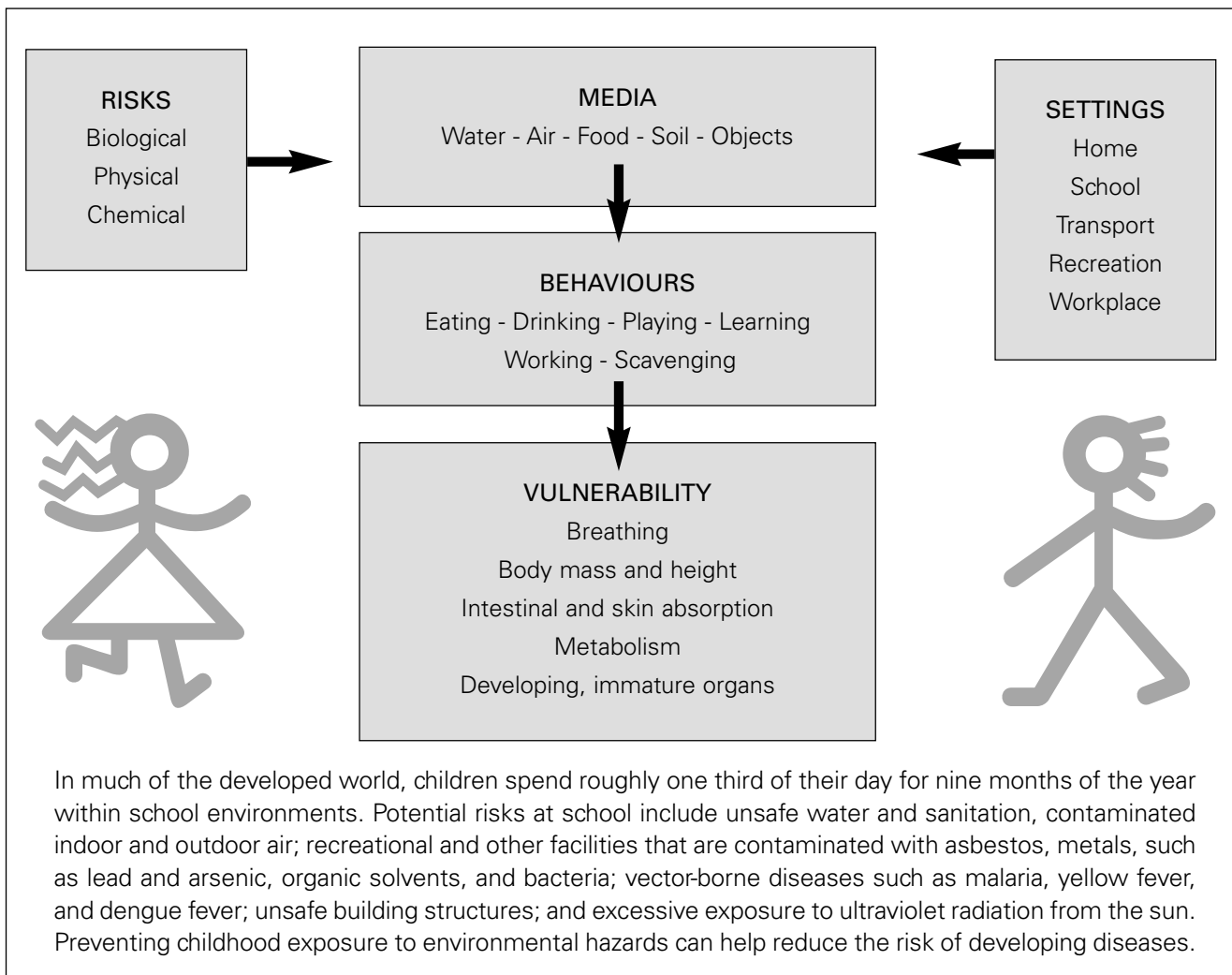
2.2 Argument: Children are more susceptible to environmental diseases than adults and therefore need healthy school environments

Children under five years of age experience over 40% of all environment-related illness.⁵⁹ Children living in poor populations in rural and peri-urban areas in developing countries are particularly affected. These children face health risks from living in an environment that lacks clean air, water, and food, and from hazardous chemicals associated with rapid economic and urban development.⁶⁰ (see Figure 2)

Children are more susceptible to the harmful effects of chemical, biological and physical threats in their environment for the following reasons:⁶¹

- Children are in a dynamic state of growth and their nervous, immune, respiratory, endocrine, reproductive and digestive systems are still developing. Their ability to detoxify and excrete toxins differs from that of adults. Exposure to environmental toxicants during certain stages of development can irreversibly damage the normal development of organs and systems.
- Young children breathe faster, and eat and drink more in proportion to their body weight than adults. They drink 2.5 times more water, eat 3 to 4 times more food, and breathe 2 times more air. Children therefore absorb more toxicants contained in air, water or food, which makes them more vulnerable to acute and chronic effects of environmental hazards.
- Children often have a greater exposure to environmental hazards than adults: they are closer to the ground where many contaminants settle and young children commonly put their hands into their mouths.
- The longer lifespan of a child increases the risk of developing diseases with long latency periods such as cancer.

Figure 2: Children's complex environment



2.2.1 Water and sanitation

Around 1.1 billion people (one sixth of the global population) lack access to improved drinking water sources.⁶² Even sources of water thought to be safe may be affected by microbiological or chemical contamination. For example, where the water distribution systems in urban areas function intermittently, contaminated water may infiltrate into the pipelines. In Bangladesh as well as many other parts of the world, contamination of groundwater with arsenic is a major public health problem.

The Global Water Supply and Sanitation Assessment reported that 2.4 billion people globally did not have access to any type of improved sanitation facilities in 2000.⁶³ These facts indicate that billions of people around the world, especially the poor, are at serious risk of contracting diseases such as diarrhoea, intestinal parasitic infections, trachoma, schistosomiasis, and of being exposed to high concentrations of heavy metals or chemicals (see Box 3).

Box 3: Potential health effects of water pollutants

- Diarrhoea
- Cancer
- Kidney failure
- Liver damage
- Birth defects
- Neurological disorders

2.2.2 Indoor air pollutants

For many children, much of their school day is spent indoors. The air they breathe inside their school may be more polluted than outdoor air. Poor indoor air quality may increase rates of asthma, allergies, and infectious and respiratory diseases, and affect student performance of mental tasks involving concentration, calculations, and memory.⁶⁴ Symptoms associated with poor indoor air quality are listed in Box 4.⁶⁵

Box 4: Symptoms associated with poor indoor air quality

- Headaches
- Fatigue
- Shortness of breath
- Coughing, sneezing
- Eye and nose irritation
- Dizziness

In many rural schools in developing countries, fuels such as dung, wood and coal are used for heating and the preparation of school meals, exposing students to high levels of particles and other toxic pollutants. Cooking and heating with simple fuels is likely to be the most prominent source of indoor air pollution in developing country schools but additional pollutants may include airborne bacteria and viruses, molds and fungal growths, and particles from building materials.

In schools in industrialized countries, indoor air pollution may be the most prevalent of all environmental hazards. Over half of the schools surveyed in the United States reported at least one environmental problem affecting indoor air quality.⁶⁶ Problems include molds and toxic fungi; pesticides; volatile organic chemicals emitted from cleaning products, photocopiers, and classroom furnishings; radon gas and outdoor pollutants entering the school buildings; airborne asbestos from insulation, and lead released from paints and other building materials (Box 5). Faulty heating, ventilation, and air conditioning systems can exacerbate air quality problems. "Sick building syndrome," manifested by headaches, nervous system effects, and respiratory problems, is routinely reported to American school nurses.⁶⁷ The syndrome became prevalent in the 1970s and continues today with the construction of airtight buildings designed to conserve energy.

Box 5: Sources of air pollutants in classrooms

- Outdoor emissions (e.g. diesel exhaust from school buses that is pulled into school air ventilation systems or flows through open windows and emissions from nearby land uses such as industrial facilities, agricultural lands or transportation corridors)
- Carpet (e.g. formaldehyde)
- Tobacco smoke (e.g. faculty lounges)
- Commercial products (e.g. paints, cleaning agents, pesticides, and air fresheners)
- Vapors from supplies and equipment (e.g. laboratory chemicals, photo and art supplies, copying and printing equipment, dry erase markers)
- Radon gas, carbon dioxide, carbon monoxide
- Lead
- Animals and insects
- Molds and fungi
- People (e.g. transmission of bacteria and viruses)

2.2.3 Outdoor air pollutants

In urban settings, children are exposed to outdoor air pollution from industry and traffic exhaust fumes on their way to school, and outdoor air pollutants may enter into the classroom. Box 6⁶⁸ outlines the range of health effects associated with outdoor air pollution. These health effects are difficult to quantify, but WHO estimates that worldwide about 800 000 annual deaths and 0.8% of all DALYs are caused by outdoor air pollution.⁶⁹

Air pollution is a global health threat to children. Nearly 80% of 105 European cities surveyed exceeded WHO air quality standards for at least one pollutant.⁷⁰ In Western Europe, asthma cases have doubled in the last ten years.⁷¹ In the United States, the number of asthmatics has leapt by over 60% since the early 1980's and deaths have doubled to over 5 000 per year.⁷² In the Russian Federation, over 200 cities often exceed pollution limits and air pollution has been implicated as a contributing factor to 17% of childhood illnesses.⁷³

Air pollution in developing world cities is estimated to be responsible for 50 million annual cases of chronic coughing in children younger than 14 years of age.⁷⁴ In Beijing, Delhi, Jakarta, and Mexico City, pollution levels sometimes exceed WHO air quality standards by a factor of three or more. In some of China's major cities, particulate levels are as much as six times the WHO guidelines. Throughout the world, as many as 1.5 billion urban residents breathe air exceeding WHO air quality standards.⁷⁵

While all school children incur health risks as a result of exposure to air pollution, children with asthma need to be particularly concerned because they are 40% more likely to have an asthma attack on high outdoor pollution days.⁷⁶ Even short-term increases in air pollution levels have been associated with an increase in asthma symptoms in children.⁷⁷

Box 6: Health effects of outdoor air pollution
Acute/transient effects
<ul style="list-style-type: none">• Wheezing and cough• Lung function decrements• Lower respiratory tract infections• Exacerbation of asthma
Potential chronic effects
<ul style="list-style-type: none">• Chronic obstructive lung disease• Exacerbation of asthma• Cancer

2.2.4 Ultraviolet radiation

The majority of lifetime sun exposure for most people occurs during childhood. Ultraviolet radiation exposure and sunburn during childhood constitute an important risk factor for several long-term health effects, among them skin cancer and cataracts. Damage is preventable through sensible sun exposure behaviour.⁷⁸ It is important to target children's attitudes and behaviour at a young age, particularly during primary school, when they tend to be most receptive. Preventive health habits developed at a young age may persist into adulthood and can enable healthy adulthood and ageing. Schools are vitally important settings to promote sun protection, as during the first 18 years of life a significant proportion of time is spent at school where sun exposure may occur.

2.2.5 Pesticides

Children may be particularly sensitive to the cancer-causing and other adverse effects of pesticides, and accumulate a large percentage of their lifetime health risk during childhood.^{79 80 81} Exposure to pesticides at school may result from their application both indoors and outdoors. Children in both developing and industrialized countries may also be exposed to pesticide residues in drinking water, food and objects such as books and toys.

Pesticides are widely misused due to misunderstanding of their toxicity by applicators. Labels rarely provide a complete and accurate summary of pesticide health threats. Pesticides like DDT have been banned or restricted in many countries, but are still widely available in others. In a school in Costa Rica for the children of workers in a banana plantation, health problems were reported to be overwhelmingly respiratory and eye infections. The school was located in the center of the plantation and was regularly sprayed with insecticide from the plantation's aircraft.⁸²

Several recent studies in various parts of the United States found that nearly 85% of schools were treated with pesticides, with no notification or vacancy requirement prior to spraying.⁸³ Some of the pesticides used have the potential to cause short-term or long-term health effects, including vomiting, diarrhoea, convulsions, headaches, skin irritations, liver damage, neurological problems, and behavioural and emotional disturbances. Other pesticides used in schools were labeled with warnings of health effects that may include reproductive system disorders, flu-like symptoms and asthma-like problems. In addition to using pesticides in and around school grounds, many industrialized countries use "pressure treated lumber" that has been impregnated with pesticides to build play sets and picnic tables. In the United States, new regulations on pressure treated lumber will help avoid this problem in the future.

2.2.6 Food

In 2002, UNESCO estimated that nearly 5 500 children die each day from bacteria in food. Unsafe food remains a widespread public health problem in all parts of the world. Surveys in New Zealand, Europe, and North America suggest that each year up to 10% of the population suffer from diseases caused by unsafe food.⁸⁴

Box 7: Foods implicated or suspected to have caused disease in school children or college students

- In 1984 in Malaysia, 114 students were infected with *Bacillus cereus* from eating fried noodles.
- In 1993, 80 children aged six and under were infected by *Bacillus cereus* in the United States, from eating chicken fried rice.
- Cake with cream topping infected 14 school aged children in Saudi Arabia in 1992 with *Salmonella typhi*.
- In 1981 in the United Kingdom, 2500 children were infected with *Campylobacter enteritis* by drinking milk.
- 8 753 children in Japan were infected in 1996 by *E. coli* from eating radish sprouts
- 152 children aged 7 to 12 were infected with *E. coli* in Indonesia, when they ate sweetened green-bean porridge with coconut milk. Two deaths resulted.

E. coli bacteria are a major cause of diarrhoea and kidney failure that can be fatal in children. The largest ever outbreak occurred in 1996 in Japan, affecting 6 300 school children and 92 staff members and resulting in two deaths. The probable cause was determined to be fresh radish sprouts (see Box 7).⁸⁵ Another large *E. coli* outbreak occurred in Africa: contaminated drinking water and cooked maize infected thousands of people.⁸⁶

In developing countries, a polluted environment, lack of a safe water supply and poor sanitation increase the likelihood of food contamination.

Worldwide, most outbreaks result from improper food handling such as use of contaminated equipment; contamination by infected persons; use of contaminated raw ingredients; cross-contamination; and addition of toxic chemicals or use of food containing natural toxins.⁸⁷

2.2.7 Hazardous location

Lands near or directly beneath schools in many parts of the world may pose health threats to children. Schools located near transportation corridors, bus depots, industrial sites, abandoned lots, landfills, military bases, utility plants, and construction sites may present health problems to the students and staff occupying the school.

New schools are difficult and expensive to site and are often constructed on undesirable lands. One of the most famous American examples is the Love Canal dumpsite in Niagara Falls, New York. Two schools constructed on a former industrial landfill were closed after testing showed excessive levels of contamination. The construction of another American school had to be halted because of the recognition that the site was an abandoned oil field containing methane and hydrogen sulfide gases.⁸⁸ In developed countries, enormous sums of money are spent remediating schools that have been built on hazardous land.

Many schools are located adjacent to highways causing students' and staff's exposure to high concentrations of vehicle exhaust, which is known to contain several cancer-causing substances and at least 50 toxic air pollutants.

2.3 Argument: Implementing changes in the school's physical environment can improve children's health

There are potentially many changes that can be implemented to improve a school's physical environment and, ultimately, the health of students and staff. These changes can serve to educate students, teachers, and parents about the relationship between the environment and health. For example, providing shade from a sweltering sun either by planting trees or building shade structures and encouraging the use of clothes, hats and sunglasses can reduce exposure to the damaging effects of ultraviolet radiation. Minimizing the use of pesticides in schools while educating teachers and students about why this is important can lead to a heightened awareness about the hazards of pesticides in the community. Implementing changes in the physical environment to improve indoor air quality with the goal of reducing respiratory illness and asthma will educate students about managing their own environment to improve respiratory health. Students can, in turn, educate their parents about these management techniques. Health education activities brought home from school by children have been found to positively influence parents' self-management of asthma.⁸⁹

3. Convincing others that improving the physical school environment will protect health

This section provides information that can be used to convince policy-makers and other decision-makers that improvements to the physical environment will benefit health and school attendance, and can be achieved at little or no cost.

3.1 Argument: Children's health can improve with low-cost interventions to the physical environment at schools

Schools can implement policies and procedures that can improve the health of students at little or no extra cost. Some examples include:

- Reducing risk of diseases such as malaria, dengue fever and schistosomiasis by improving drainage to eliminate formation of puddles where mosquitoes and other vectors breed.
- Adjusting behaviour to avoid risks. Scheduling outdoor activities during periods of the day when air pollution and sun exposure are lowest and insects are not feeding can reduce children's exposure to toxic air pollution, ultraviolet radiation, and insects that transmit diseases.
- In areas where school children cross busy roads, crossing guards or older children can assist younger children and reduce the risk of accidents.
- Prohibiting the idling of school bus engines can minimize exposure to diesel and gasoline exhaust fumes. Buses should not idle in areas around schools where fumes could enter the school building.
- In the developing world, where children dip unwashed hands into a shared drinking water source, a ladle may be used to fill cups or bowls providing a low-cost solution to cleaner water.
- Teaching young children basic rules of food safety such as washing hands before eating.
- Establishing safety rules in the handling and preparation of foods.
- Planting shade trees around school grounds to reduce the risk of overexposure to the sun's ultraviolet rays.
- Creating a health committee with a mission to ensure that classroom facilities and grounds are safe and healthy for children.
- Sorting and recycling waste.
- Reducing respiratory infections by using improved stoves and increasing ventilation when polluting fuels are used inside schools for cooking and heating.
- Reducing asthma attacks by improving ventilation to enhance indoor air quality. Depending on the location of the school, ventilation in classrooms may often be improved by simply opening a window. Where resources permit, additional options can be considered.
- Reducing pesticide exposure and poisonings by eliminating/minimizing use of pesticides. Schools adjacent to locations where pesticides are routinely applied could learn about the timing of pesticide applications and keep children inside the school with windows and doors closed.

Further suggestions on improving the physical environment at schools are provided in Section 5.2.1.

3.2 Argument: Improvements in the physical environment at schools can increase school attendance

In the developing world, providing separate sanitation facilities for girls is an important contributing factor in reducing dropout during and before menses. Educated girls marry later in life, have fewer children and are more likely to seek health care for themselves and their children. An increase in the number of girls who stay in school is likely to lead to a reduction in childhood mortality, improved children's health and nutrition, and a deceleration in population growth. Female education has the greatest return on the dollar of all investments available in the developing world.⁹⁰

Eliminating air pollutants that trigger asthma attacks and other respiratory illnesses can help improve attendance in high and low income nations. In the United States, asthma is believed to be the most common reason that students miss school.⁹¹

4. Planning interventions for health protection in school environments

The preceding sections demonstrate that children's health and educational potential depend on the quality of the physical school environment. Building capacity to protect children's health and educational potential will demand changing knowledge, perspectives, and priorities. It will also require collective decisions to adopt new policies, and make commitments to pursue specific plans for health risk reduction. The following procedural steps could help guide this reform. Further information on how to implement these procedural steps and guidance on how to mobilize resources is given in *Local Action: Creating Health-Promoting Schools* (Box 8).

4.1 Procedural steps toward creating a healthy physical environment at schools

- **Participation:** Organize broad participation to design and implement plans to create healthy school environments. Participants could include school administrators; managers of facilities, transportation and grounds; parents; students; community leaders; and experts in public health and environmental protection.
- **Threat identification:** Conduct research to identify the magnitude and relative importance of significant threats to health within the school environment. Threats may be associated with the following: water quality, sanitation, air quality, food safety and nutrition, vector-borne diseases, waste management, pesticide use, hazardous chemical management, transportation, adjacent land uses, structural integrity, renovation, purchasing, and grounds management.
- **Goal identification:** Establish clear and measurable goals to reduce significant threats.
- **Design of intervention plans:** Design specific intervention plans to improve health-promoting practices in the following areas: water quality, sanitation, air quality, food safety and nutrition, waste management, pesticide use, hazardous chemical management, transportation, facility siting, structural integrity, renovation, purchasing, and grounds management.
- **Implementation of plans and evaluation of progress:** Implement the intervention plans. Define timetables to meet goals, and assign clear responsibility and accountability. Routinely evaluate progress in goal attainment, and the effectiveness of interventions. Adjust policies, intervention plans, and methods of implementation in response to evaluations, changing conditions and availability of resources.

Box 8: Local Action: Creating Health-Promoting Schools forms part of the *WHO Information Series on School Health*. It offers school leaders help in developing ideas and organizing activities to identify health problems in their school and community, and to take steps to improve health. It provides guidance and tools for assessing local health problems; identifying resources; defining goals, objectives and action plans; and documenting progress.⁹²

4.2 Goals identification

Successful protection of children from environmental threats at school requires careful definition of problems and goals to resolve them. Goals are grouped into two categories: substantive goals and procedural goals.

4.2.1 Substantive goals

- **Hazard reduction:** Reduce exposure to significant physical, biological and chemical threats to children's health within the school environment.
- **Education:** Educate school administrators, teachers, parents, health providers, political leaders and community members about direct and indirect relationships between the school environment and health.
- **Surveillance:** Create an effective system to monitor and record infectious and chronic disease prevalence, and environmental hazards within the school environment.
- **Health service delivery:** Develop capacity to provide fundamental emergency medical care within each school.
- **Food:** Provide safe and nutritious meals for students.
- **Water:** Provide safe water at schools for drinking, cooking and washing.
- **Sanitation:** Provide clean and well maintained sanitary facilities, separate for males and females.
- **Transport:** Provide safe passage between homes and schools.
- **Waste:** Create a secure and effective system for waste collection, storage and removal.
- **Facilities:** Ensure structural integrity of school buildings, use of safe building materials, and health protective renovation procedures.
- **Grounds:** Prevent students from exposure to dangerous conditions on grounds, such as rivers, ravines, flood prone areas, rockslides, or highways. Manage grounds to prevent diseases carried by rodents or insects.
- **Hazardous materials storage:** Ensure that hazardous materials are stored safely and securely, preferably in a structure detached from educational facilities. Hazardous materials include fuels, solvents, some cleaning supplies, paints and wood finishes, pesticides, and vehicle fluids.
- **Pesticides:** Restrict use to situations where pesticides will confer a health protective benefit, such as reducing insects that carry diseases, and then employ only the least toxic alternatives.
- **Tobacco:** Eliminate use of tobacco on school grounds.
- **Green purchasing:** Develop criteria to guide purchasing of products and services that will better protect the environment and children's health. Categories of products for which low risk options should be identified include: food, vehicles, fuels, furnishings, cleaning products, building materials, pesticides, paints and wood finishes.

4.2.2 Procedural goals

- **Participation:** Create decision-making processes that encourage broad community participation in goal formulation, policy development, intervention design, implementation and evaluation.
- **Transparency in decision-making:** Make decisions and deliberations in open meetings.
- **Freedom of information:** Information and records on hazards in the school environment should be publicly accessible.
- **Protection of privacy:** The privacy of individual medical records should be protected.
- **Fair warning of significant hazards:** If school officials recognize unusually hazardous situations, the community should be promptly warned (e.g. lead water piping, bacterial contamination of food or water, pesticide applications, asbestos in renovation debris).

4. PLANNING INTERVENTIONS FOR HEALTH PROTECTION IN SCHOOL ENVIRONMENTS

- **Timely response:** The community should expect a timely response by school officials to credible evidence of health hazards.
- **Equity:** Implement interventions to achieve an equitable reduction in exposure to hazards within school environments.

4.3 Participation in planning the interventions

Effective protection of health and enhancement of education require school and community involvement in the planning of interventions. Two important groups that could be involved in the planning process are a school health team and a community advisory team.

4.3.1 Form a school health team

A school health team may be designated to coordinate and monitor health-promoting policies and activities. If a school does not have a health team, planning to improve the school's physical environment can provide the opportunity to form one. Valuable members of the school health team could include teachers, administrators, school nurses, students, parents, transport managers, facilities managers and groundskeepers.

Specific task forces can be organized to focus on specific health concerns such as health surveillance and evaluation, health service delivery, sanitary facilities, water quality, food preparation and safety, waste management, transport, vector-borne disease management, pesticide use, structural facilities, renovation, purchasing, and grounds.

4.3.2 Establish a community advisory committee

Planning improvements to the physical environment provides an opportunity to work outside the school with those who have an interest and expertise in the relationship between the environment and health. Potential partners from the community include parents, childcare centers, local government representatives, businesses, residents, non-governmental agencies, health service providers, environmental organizations, and experts in facility design, construction, renovation, grounds management, waste management, transport, and infectious diseases. The community advisory committee could:

- Identify specific problems and goals;
- Provide expertise for design and implementation of intervention plans;
- Disseminate information about environmental health issues, in particular regarding children;
- Encourage broad community involvement and support;
- Search for financial support and voluntary contributions to meet the goals of the intervention plans.

4.4 Intervention plans

Schools could develop intervention plans that include:

- **Purpose statement:** A general purpose statement should address the need for hazard reduction, environmental quality, safety assurance, education, surveillance, and health service delivery.
- **Problem identification:** Problems should be identified and ranked in order of relative significance to provide priorities given limited budgets and time.
- **Goals and objectives:** General goals and specific objectives should provide clear and measurable targets for environmental improvements.
- **Procedural policies:** Policies should be adopted to structure participation, transparency in decision-making, access to information, confidentiality and privacy of medical records, warning of significant hazards, timely response to significant threats, and equitable reduction in exposure to hazards within school environments.
- **Specific intervention strategies:** Specific strategies should be designed to protect or improve the following components of the school environment: nutrition and food safety; water quality; air quality; sanitation facilities; transportation; waste; facilities design, construction, renovation and maintenance; grounds; hazardous materials storage; pesticide use; and purchasing.
- **Educational strategy:** Each plan may also include an educational strategy, addressing important problems through curricular and extracurricular efforts.
- **Responsible parties:** Specific individuals should be assigned responsibility to develop and implement components of intervention plans.
- **Financial analysis:** Each plan should include a financial analysis estimating the cost of goal attainment, and potential sources of funding or voluntary service and materials.
- **Evaluation:** Each plan should include criteria for evaluating progress and goal attainment.
- **Community outreach:** Each plan should consider how the expertise, labour and financial resources of community members might be helpful in achieving goals.

4.4.1 Identify information needs

Both qualitative and quantitative data are necessary for planning effective environmental health interventions, and to establish a baseline for evaluation. Qualitative data include perceptions, beliefs, and attitudes; quantitative data include numerical information. The following information could help determine local needs and priorities in relation to the school environment:

- Health trends at the national, regional, local and school level, if available.
- Environmental status and trends at the national, regional, local and school level, if available.
- Knowledge, attitudes, beliefs, values, behaviours and conditions related to the environment and health.
- Available resources, both personnel and financial, and commitment to health within the school and community.
- Ongoing initiatives in the community, in other schools, or in the country that may provide support.
- Status of existing school and community programmes that might help to implement improvements to the physical environment.

Table 4: Basic questions and information sources

Basic questions	Methods for data collection
What health issues are a cause of concern in the country, community and schools (e.g. acute respiratory infections, diarrhoea, injuries, infectious diseases, asthma, malaria, pesticide poisonings, lead poisoning, learning disorders, childhood cancers)?	Review of local, regional, and national health data, mortality and morbidity rates, and disease burden; review of school data on absences, type of illnesses, and medications administered. Consultations with health clinics, health departments, hospitals, or medical schools.
What physical conditions exist in schools that may impact the health issues of concern (e.g. wood smoke in schools, access to clean drinking water, poor drainage and dampness, unsafe food preparation and storage facilities)?	Interviews with school officials, teachers, facilities managers, general practitioners, pediatricians, primary health professionals such as nurses, parent panels etc. Surveys or questionnaires, observations, research data.
What resources are available at the school and community level to provide improvements in the physical environment of schools?	Interviews with school and community leaders.
Do teachers, school nurses, parents and children have basic knowledge about managing respiratory infections, asthma, and diarrhoea?	Observation, questionnaire/survey.
Do teachers, school caretakers, parents and children have basic knowledge about important environmental health risks identified in their school and community, such as unclean drinking water, lack of sanitation, air pollution, and pesticide exposure?	Observation, questionnaire/survey.
Are classrooms well ventilated? Do they receive adequate natural light? Are they able to control excessive noise?	Observation, questionnaire/survey.
Is safe water available for drinking, washing and cooking? What are possible threats to the school's water supply?	Interviews with school and community leaders, observation, water quality testing, inspections.
Are safe food preparation and storage practices followed?	Interviews, observation.
Are school buildings structurally sound? Are safe building materials being used in the construction, renovation, and furnishing of school buildings and play areas? Are the buildings safe, e.g. broken stairs, broken furniture?	Routine inspection and record keeping.

Table 4: Basic questions and information sources (continued).

Basic questions	Methods for data collection
Are schools built on “safe” land (e.g. contaminated site, hazardous conditions, flood prone, high water table)?	Inspection.
What physical hazards exist on or adjacent to school property (e.g. water bodies, steep terrain, busy highways, waste sites, polluting industries)?	Visual inspection.
Are relevant environmental health issues adequately addressed within the school curricula?	Interviews with school officials and teachers, curriculum review, observation.
How are hazardous chemicals stored and used on school grounds? What is the potential for student or staff exposure?	Inspection, interviews with facilities manager, staff members, and students.

4.4.2 Answer basic questions and identify key information sources

Table 4 lists basic questions and some methods for collecting information to plan environmental health interventions. Because the environmental hazards within schools vary greatly among countries and even among schools within a given country, it is important that collaboration between the school and community takes place to identify additional questions and resources available for data collection.

4.5 Commitment and policies

Making improvements to a school’s physical environment will require understanding and commitment from a wide range of individuals and groups, including relevant government departments, health and education authorities, community and business leaders, educators, parents, students, and the community.

4.5.1 Gain national political commitment

Successful reduction of environmental health threats within schools demands political commitment at all levels of government. Political leaders will need to understand the importance of the threat. Experience in some nations suggests that recognition of school environmental health problems results from the educational efforts of community and grass roots organizations. National legal authority, expertise, and financial support may be necessary to implement change, especially within the poorest communities.

Political commitment and support may occur in the form of:

- **Support for research:** Research to understand more fully the extent and distribution of environmental health threats faced by children in schools is often necessary. Although hazards may vary from classroom to classroom, national and regional governments and universities can show commitment by providing support and/or expertise to implement needed research. Results of such research can also be publicly acknowledged and disseminated by national authorities.
- **Authority and responsibility:** National authority to set standards for physical school improvements may be necessary to bring about significant change. This authority could require the provision of safe food and water; attainment of sanitary standards; and establishment of pollution limits and building standards.
- **Financial commitment:** Financial support for construction, maintenance, health surveillance, medical services, and environmental hazard assessment and intervention may all be necessary to assure sufficient health protection for children in schools. Training, equipment, and materials may be required to enable schools to develop and implement physical improvements. Many communities lack the financial resources necessary to provide these services, and will need financial commitments from provincial or national levels.

4.5.2 Achieve community commitment

A healthy school environment requires community support. Parents and community members need to participate in the development and evaluation of interventions to improve school health. Commitment and the support of many parties on a variety of levels are necessary to share expertise, facilities, and resources. Community group meetings, parent-teacher conferences, open houses, and formal presentations are all opportunities for involving family and community members early in the development process.

Community commitment may be enhanced by:

- Public recognition of the association between health and the environment by community leaders, local government representatives, health and education authorities, and other relevant organizations.
- Establishment of a designated committee for coordinating efforts to improve the physical environment of schools.
- Provision of local resources for interventions to improve the physical environment of schools.
- Coordination of interventions with other programmes in the community (e.g. malaria control, food safety initiatives, asthma education, pesticide awareness, recycling initiatives, implementation of environmental management systems).
- Efforts to attract community and media attention (e.g. through printed material, community forums, school events).

5. Integrating environmental health improvements within various components of a health-promoting school

A health-promoting school draws on the school's full organizational capacity to improve the health of students, school personnel, families and community members by improving

Box 9: Components of a health-promoting school
<ul style="list-style-type: none">• Skills-based health education• A healthy school environment• School health services• School health policies

the physical environment of the school and educating the school community about environmental health threats. Physical improvements to schools can serve as an entry point for the development or enhancement of policies, planning groups, and various components that serve as a framework for a health-promoting school. The key components are listed in Box 9.

The effectiveness of interventions integrated into each of these components is influenced by the extent to which they are supported by a variety of people, policies, and trained staff and by the extent to which interventions in each of these components combine with other health promotion efforts to complement and reinforce each other.

Most schools will not have the resources to address all the environmental health issues that might be identified at once. Each school must establish its own priorities, in collaboration with all parties concerned, to decide the extent to which identified issues should be addressed. A health-promoting school should enable students, parents, teachers and community members to work together to make these decisions. Schools should start with small changes that are feasible rather than waiting until resources become available to address all of the issues at once.

5.1 Skills-based health education

Physical changes alone will not suffice to create a health-supportive physical environment at schools or in communities. Students, and the adults they will soon become, will need to acquire knowledge, attitudes, values and skills to sustain improvements and address new challenges in the environment. Skills-based health education, along with school health policies, school health services and a health-supportive school environment are considered the basic components of an effective school health programme. They are complementary and reinforcing of each other. Skills-based health education should increase awareness of environmental threats to health, generate a feeling of responsibility for health and the environment, and improve the health of students. It should inform students about how to avoid health risks and how to create an environment that is conducive to healthy living. It should be designed to contribute to improvements in the physical school environment including the school site and buildings, indoor and outdoor air quality, and school-related activities affecting the environmental quality of schools.

Collaboration between education and health officials, the school health team, the community advisory committee and other school and community members is necessary to identify knowledge, attitudes, behaviours, skills and services students need to acquire to protect themselves from illness and hazards associated with the physical environment at school or in their communities, and to help improve environmental conditions that affect health.

5. INTEGRATING ENVIRONMENTAL HEALTH IMPROVEMENTS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL

Skills-based health education (see Box 10) should occur sequentially from primary through secondary levels. It can be taught as a specific subject, as part of other subjects, or as a combination of both. It should be part of the school health curriculum, and also integrated into a range of subject areas, as relevant. Integrating ideas on environmental health within existing curricula on health, natural science, social science and the humanities offers opportunities to consider environmental health problems from multiple perspectives and within multiple contexts. For example, in science lessons, students can learn to use scientific methods to identify environmental threats to their health and their family's health, and to find effective ways to reduce such threats. Even though education about the environment can be incorporated into many subject areas, it should be a core component of school health education classes and a prominent subject in health promotion programmes for staff.

Educational materials and teaching strategies for environmental health-related issues are available through some governmental and non-governmental agencies and organizations, universities, or teachers' unions. Supplemental materials specific to the local environment can also be generated by teachers in collaboration with health officials, the school health team, the community advisory committee and other school and community members who can help identify the physical environmental conditions that affect children's health in the community.

Ideas for educating primary school children in developing countries about environmental health threats are available in *Food, Environment, and Health: A Guide for Primary School Teachers* published by WHO.⁹³

Box 10: Skills for Health, Skills-Based Health Education, including Life Skills: an Important Component of a Child Friendly/Health-Promoting School forms part of the *WHO Information Series on School Health*. It provides practical guidance about designing health education to address important public health issues, including education to complement and reinforce interventions to create a healthy school environment.⁹⁴

Annex 1 provides some examples of education strategies that can be used to promote environmental health in the classroom.

5.1.1 Methods and materials for skills-based health education in relation to the environment

A variety of educational methods, including lectures, debates, discussions, experiments, hands-on activities, audio-visual aids, and role-plays are effective tools for environmental health education. These methods should be designed to increase knowledge, build positive attitudes and values, dispel myths, increase skills and provide support for a healthy lifestyle. Methods should be selected on the basis of lesson objectives. For example, a lecture is an effective way to increase knowledge but is less effective in influencing beliefs than discussions or debates. In educating students about the physical environment, practical information that will enable students to reduce their exposure to unhealthy environments and create safe and supportive environments should be emphasized.

5.1.2 Training teachers to implement skills-based health education in relation to the environment

Teachers need to receive training and information to incorporate effectively issues related to health and the environment in their subject area (Box 11). Teachers could be provided with information about basic relationships between the environment and health, and with learning materials to make the content interesting to their students. They could also be instructed on how to generate a feeling of responsibility toward the environment.

Teachers primarily responsible for health and science education could receive training in implementing a curriculum targeted at health issues related to the physical environment of the school and local community. This training could be continuous and address content and teaching strategies.

All teachers should serve as role models for students by demonstrating responsible classroom management practices. They should be encouraged to keep their classrooms healthy by providing adequate ventilation, cleaning them with non-toxic cleaning products, minimizing/eliminating mold growth, disposing waste properly, and recycling classroom materials.

Box 11: A healthy schools initiative case study: Trinidad and Tobago

The Ministries of Health and Education in Trinidad and Tobago, along with The Pan American Health Organization (PAHO), recently produced a manual entitled "Schools' Environmental Health and Safety Manual." The manual was written for use by school principals, school administrators and teachers, providing them with information on environmental health risks, together with guidelines for action for the creation and maintenance of healthy environmental conditions in schools. There are five chapters covering the topics of: water and sanitation, vector control, waste management, food safety and disaster preparedness. The sixth chapter outlines the responsibilities of other government agencies in providing support for maintaining healthy environmental conditions. Included are the agencies' contact telephone numbers and the telephone numbers of emergency services.

The Ministry of Health, in partnership with PAHO and major stakeholders in the country, has also embarked on a comprehensive healthy space initiative focused on developing a network of Health-Promoting Schools and Healthy Communities to provide a supportive environment which targets the school population and its wider community. The initiative builds on and strengthens ongoing interventions in order to improve efficiency, reduce cost, and increase impact at local level. A national school health policy has been prepared, the plan of action has been approved and more than one million US dollars was committed by the Government to support the first phase of the process, while it is streamlined into the regular institutional budgets.

5.1.3 The student's role in skills-based health education in relation to the environment

Throughout the world, children are the future caretakers of the environment and will become stewards of their own health and that of others. Their knowledge of the environment and their understanding of the relationship between their own health and

5. INTEGRATING ENVIRONMENTAL HEALTH IMPROVEMENTS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL

the environment shape the attitudes children develop toward the environment. One effective way for students to learn about their environment is for them to become active participants in environmental health education. The child-to-child approach, developed at the Institute of Child Health and Education, University of London is based on the observation that children play a central role in the care of their younger siblings and that traditional knowledge and health practices of villages are passed on from parent to child and from child to child. In the child-to-child model, there are four fundamental ways children can serve as health agents for their communities:⁹⁵

- Older children can help younger ones. Children can be taught how to teach their younger siblings to manage their own health.
- Children can learn from others of the same age by doing small projects together.
- Children can pass on health messages that they have learned to the larger community.
- Children cooperate to create health actions with their communities.

The child-to-child approach is an effective approach to teaching because:⁹⁶

- It links what children learn with what they do;
- It links what children do in class with what they do in the home;
- The activities are not taught in one lesson and then forgotten; they are learned and developed over a long period of time.

The training materials developed by the Child-to-Child Trust deal with environmental issues such as community-wide water and sanitation surveys, action programmes, and solid waste management schemes. They are available at <http://www.child-to-child.org/resources/index.html>. A similar approach has been adopted by the Indian non-governmental organization HRIDAY-SHAN (Box 12).

Box 12: Students as informed health activists

In Delhi, students aged 10 to 13 receive health education about the environment while participating in the HRIDAY (Health Related Information Dissemination Amongst Youth) programme. As they progress to senior grades, they are introduced to SHAN (Student Health Action Network) programme, wherein these well-informed students learn to identify various health problems and existing government policies linked with those problems. They are motivated to voice their opinions and suggest action to the government, with support from schools and communities. These intervention programmes are particularly important for students, because children are the most vulnerable victims of a degraded environment as well as powerful agents for remedial social change.

The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care provides additional information about children's participation in environmental interventions.⁹⁷ In this book, case studies of children's participation from urban and rural, poor and middle-class communities in both developed and developing countries are provided. The book includes successful models, practical techniques and resources for involving young people in environmental projects.

5.2 A healthy school environment

The preceding sections of this document have made the case that the condition of a school's physical environment can impact the health of both students and staff. It has been demonstrated that all members of the school community need clean air to breathe, clean water to drink, a safe place for recreation, a safe way to travel to school to avoid accidents, and protection from extreme temperatures and ultraviolet radiation. A safe and healthy physical environment requires a good location and safe buildings; protection from excessive noise; natural light; clean indoor air and water; a healthy outdoor environment; and healthy school-related activities including safe management and maintenance practices, use of non-toxic cleaning supplies, careful use of pesticides, vector control, and use of non-toxic art supplies. With the importance of children's environmental health in mind, this section offers actions to create a healthy school environment.

5.2.1 A safe school location and structure

Find a good school location

Before a school is constructed, planners and community groups need to consider potential environmental risks in relation to the school's location, e.g. the vicinity of a chemical plant or former waste site, an area prone to flooding, or a busy, noisy road (Box 13).

Options for improving existing schools on poor sites include hazardous waste removal, construction of footpaths or bridges for getting to school, and construction of school barriers to provide a buffer to hazardous areas. Adjustments in behaviour can be made to account for poor environmental conditions such as avoiding recreation activities during periods of the day when air pollution is at a peak or the sun is most intense. In areas where school children are required to cross busy roads, crossing guards or older children can assist younger children. If children are required to travel to school by bus, these buses should be in good running order and exposure to diesel or gasoline exhaust fumes should be minimized.

Box 13: Guidelines for selecting a school site

- Include parents, teachers, and members of the community in the site selection process.
- Do not build schools within two miles of facilities that release toxic chemicals into the air or land.
- Contaminated sites should not be used for school construction.
- Schools should not be built in areas prone to flooding, mud slides, or other natural hazards.

Design a safe school structure

The structure of a school building should protect students and staff, but poorly designed school buildings and play areas may present serious health risks instead. School buildings are often larger than traditional domestic or residential buildings. Special construction techniques may be required to ensure safety, particularly in areas prone to natural disasters such as earthquakes and typhoons. In addition to being structurally sound, school buildings and play areas should be constructed without asbestos and with the safest, non-toxic materials available.

5. INTEGRATING ENVIRONMENTAL HEALTH IMPROVEMENTS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL

Schools should be designed to prevent temperature extremes inside classrooms. Cold, damp, and poorly ventilated classrooms provide an unhealthy environment for school children, particularly poorly nourished and inadequately clothed students who are especially vulnerable to respiratory and other infections. Extremely warm conditions may reduce concentration and attention span, and can lead to heat-related illnesses including thermal stress, fatigue, and heat stroke. One way to ensure protection from the elements is to plan school holidays so that they coincide with the rainiest, coldest or hottest season.

School siting and landscaping can affect interior conditions such as temperature, humidity, lighting, and ventilation. For example,

- Schools in heavily forested settings are often darker, cooler, and damper than those in open areas.
- Schools in depressions, wetland, or adjacent to rivers or other water bodies are normally damp.

Poorly maintained structures may also pose a health threat to children. Cracks in walls, floors, or foundations provide homes for insects such as hookworms, mites and jigger fleas. Broken windows, dilapidated steps, exposed nails, and missing stair rails present obvious hazards and increase the risk of injury.

5.2.2 Indoor school environment

Protect school drinking water

Fecal material contaminates drinking water. Children dipping their unwashed hands into a shared drinking-water supply provide a typical route of contamination.⁹⁸ In areas where this occurs, providing schools with a ladle to dip into water sources may be a low-cost solution to cleaner water. A safe water supply is free from bacteria, parasites, and toxic chemicals. Box 14 outlines important considerations for protecting a well from contamination. Where there is uncertainty about the quality of the drinking water, it should be tested regularly. If the water has not been chlorinated, it is important to disinfect it through chlorination, boiling or any other acceptable method. Safe storage of water at school and at home should also be promoted (Box 15).

Box 15: Storing water safely

- Wash containers once a day or when empty.
- Cover container tightly.
- Place the container off the floor on a box or shelf.

Box 14: Protecting a well from contamination

- Locate wells upstream and at least 30 metres from any sources of contamination such as sanitation facilities.
- Do not use pesticides within 100 metres of well.
- Regularly inspect well for structural integrity.
- Build a raised wall or fence around the well to keep animals away.
- Dig a drainage ditch around the well to prevent surface water and spilled water from contaminating the well.
- Keep water bucket clean.
- Use a raised block on which to place the water bucket to avoid contamination.
- Keep well covered.

Where helminth infections are a problem, store drinking water for over 24 hours and then decant to help remove helminth eggs that may have fallen to the bottom of the container. Boiling is an effective way to kill worms, eggs, and other germs that may have contaminated the water. A filtration system made from stones and sand or gauze/filters in guinea worm areas can also be used to make water safe from worms.⁹⁹

In the industrialized world, water supplies at school can be contaminated by chemicals present on-site as a result of former land-use practices, adjacent land uses, or plumbing fixtures. Many school water fountains have lead-soldered or lead-lined tanks. Patterns of intermittent water use from these fountains result in water standing in tanks longer than in typical residential situations, increasing the amount of lead that is absorbed into the water from the tanks.¹⁰⁰ Schools need to be aware of these potential risks and have their water tested regularly.

Provide sanitation facilities

Human excreta are the biggest source of disease-producing organisms including parasites, bacteria, and viruses. Success in eliminating fecal material from the school environment is dependent on: informed and responsible students; supervision of young students; a fence or structure to stop animals from defecating in areas where children play; toilets conveniently located, reliable, clean, odor-free, private, and well-maintained.¹⁰¹ Separate facilities for girls can reduce dropout rates during or before menses. A variety of latrine systems are used in different parts of the world depending on cultural, environmental, and economic conditions. Education and health officials need to make sure that construction of latrines is technically appropriate and acceptable.¹⁰²

Aim for good indoor air quality

The quality of indoor air is a function of building ventilation, construction materials used, and pollutants released inside the building (such as tobacco smoke, cleaning supplies, pesticides, and art supplies). It is also a function of policy, as in the case of environmental tobacco smoke.

WHO strongly recommends that schools and their grounds should be completely tobacco free (see Box 16). Breathing environmental tobacco smoke (e.g. side-stream and exhaled smoke from cigarettes, cigars and pipes) causes serious health problems. It can aggravate allergies and increase the severity of symptoms in children and adolescents with asthma and heart disease. It is also associated with lung cancer because environmental tobacco smoke contains essentially the same cancer-causing substances and toxic agents that are inhaled by the smoker.¹⁰³

Box 16: Protection from environmental tobacco smoke¹⁰⁴

Smoking should be legally prohibited in public places, especially in schools and places where children may be present. Environmental tobacco smoke (ETS) is known to be harmful, especially to children. If schools and other public places become smoke-free, young people will have far fewer places to light up, which could go a long way in reducing smoking. Finally, children who grow up seeing smoking permitted all around them will wrongly conclude that smoke is not very harmful, and that it is socially acceptable to smoke.

5. INTEGRATING ENVIRONMENTAL HEALTH IMPROVEMENTS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL

In developing countries, the indoor burning of dung, wood and coal for cooking and heating within schools can cause high levels of fine particles in indoor air that can lead to respiratory illness and trigger asthma attacks. Adequate ventilation should be provided whenever possible and students should be educated about the health effects of poor ventilation, and particles and other combustion by-products in smoke. Schools in the developing world can promote the use of improved stoves, ensure that fuel wood is dry, time cooking activities when students are outside, and ensure that smoke is vented away from places where students may study or play.

Box 17: Guidelines to improve indoor air quality in schools

- Open windows and doors but avoid ventilation during times when outdoor emissions are likely to be highest.
- Do not permit smoking.
- Regularly inspect furnaces, gas water heaters, clean air conditioners, humidifiers, and heat exchangers.
- Limit the amount of carpet used.
- Use water-based paints, wood finishes and sealants.
- Minimize use of fresheners, fragrances, deodorizers, and harsh cleansers, and ventilate when using these types of products.
- Schedule painting, floor refinishing and renovation during seasons when windows can be kept open and when school is not in session.
- Provide maximum ventilation when painting or using solvents or strong cleaning solutions.
- Store cleaning supplies, pesticides and solvents in air tight and child-proof containers out of reach of children.
- Prevent moisture problems.
- Use art supplies that are non-toxic.
- Prohibit idling of diesel school buses outside schools.
- Ensure that air intakes are not located adjacent to parking lots or exhaust vents.

A study on the causes of indoor air quality problems in schools throughout the developed world¹⁰⁵ found that most problems in school facilities could be avoided by:

- Providing adequate outdoor air ventilation on a continuous basis (15 cubic feet per minute per student).
- Controlling the space relative humidity between 30% and 60%.
- Providing effective filters to remove fine particles from the outdoor air.

The guidelines in Box 17 can also help improve the quality of air inside classrooms. Reducing dampness and improving ventilation can help prevent the growth of molds and fungi (see Box 18).

Box 18: Mold prevention tips¹⁰⁶

- Fix leaky plumbing and leaks in the building as soon as possible.
- Watch for condensation and wet spots. Fix source(s) of moisture problem(s) as soon as possible.
- Prevent moisture due to condensation by increasing surface temperature or reducing the moisture level in air (humidity). To increase surface temperature, insulate or increase air circulation. To reduce humidity repair leaks, increase ventilation (if outdoor air is cold and dry), or dehumidify (if outdoor air is warm and humid).
- Keep heating, ventilation, and air conditioning drip pans clean, flowing properly, and unobstructed.
- Vent moisture-generating appliances, such as dryers, to the outside where possible.
- Maintain low indoor humidity, below 60% relative humidity, ideally 30-50%, if possible.
- Perform regular building inspections and maintenance as scheduled.
- Do not let foundations stay wet. Provide drainage and slope the ground away from the foundation.

5.2.3 Outdoor school environment

Seek high quality outdoor air

The probability that children with asthma will have an attack is estimated to be 40% higher on high outdoor pollution days,¹⁰⁷ and research indicates that children that play active sports are more likely to develop the disease in polluted cities.¹⁰⁸

Many schools should be concerned with outdoor air quality. Equipped with some knowledge about air quality in their area, schools may choose to avoid involving students in intensive outdoor exercise during periods of high air pollution. Ozone levels usually peak between midday and evening. Avoiding outdoor activities during high pollution periods and in areas adjacent to highways or near other sources of air pollution will help to minimize asthma attacks in sensitive children and other short- and long-term health effects associated with exposure to air pollutants.

Make play areas supportive of physical development

Play areas should be designed to be more than “play” areas. There is an urgent need for children to be able to take part in regular and appropriate physical activity. Schools offer a unique setting to promote and provide opportunities for physical activity as recreation and sport. Regular and appropriate physical activity is an essential stimulus for children to reach their potential of growth and development. It is necessary for optimal health and functional capacity. It also counteracts disabilities and diseases common to ageing. Regular physical activity helps children and adolescents develop strong muscles and bones, normal body weight, efficient function of the heart and lungs, and skills of movement.

To provide an environment that encourages and enables children to engage in regular and appropriate physical activity, schools should:

- provide play areas that are safe and have facilities for physical activity;

5. INTEGRATING ENVIRONMENTAL HEALTH IMPROVEMENTS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL

- establish and enforce policies and standards for the use of equipment and grounds to prevent physical activity-related injuries;
- provide time during the day for children to have access to play areas for unstructured physical activity;
- provide access to community recreation areas when insufficient space prevents children from regular physical activity on the schools grounds.¹⁰⁹

Children need to be protected from injuries that could occur outside the school buildings, and areas where children play or exercise should be free from hazards. Busy roadways, water bodies, waste sites, rockslides, and ravines should be considered threats to children. Play areas should not be located near these areas.

When selecting wood for playgrounds or outdoor furniture that children and staff will use, avoid lumber treated with chromated copper arsenic, creosote and pentachlorophenol. Potentially toxic levels of arsenic can leach from the wood to the hands of children and contaminate the soil below where children play. Existing treated play sets can be sealed with polyurethane or painted to reduce exposure to toxic wood preservatives.

Protect children from ultraviolet radiation

Planting shade trees around school grounds can reduce the risk of overexposure to ultraviolet radiation for students and staff, particularly when the sun is at its peak. In countries such as Bangladesh, an open-air classroom with a roof may be sufficient to protect students from the sun while enhancing light and ventilation. However, reflection of ultraviolet radiation from light surfaces may still lead to significant exposure. In Australia, where skin cancer incidence is the greatest in the world, the SunSmart Schools programme of the The Cancer Council Victoria emphasizes a sun protection policy that involves the whole school community. Students in SunSmart schools wear sun-protective clothing, hats and sunglasses, apply sunscreen, avoid outdoor activities when the sun is at its highest, plant trees for shade, and study ultraviolet radiation levels at different times of the day. Such schools can apply for accreditation as a SunSmart school and receive a large metal SunSmart School sign. Over 70% of Victorian primary schools have become SunSmart Schools since the programme started in 1994. Data indicate significant improvements in policy and practices in the seven years since the introduction of the programme.¹¹⁰

5.2.4 Healthy environmental management practices

Schools can provide a role model for responsible environmental management and health protection. Other documents in the *WHO Information Series on School Health* provide additional information on some of the management practices discussed below and are referenced where appropriate.

Dispose of waste quickly and properly

Waste generated in schools should be properly disposed to avoid spread of communicable diseases, discourage the presence of pests and other vectors, and prevent human contact with potentially hazardous material (see Box 19).¹¹¹ Appropriate practices of recycling and waste disposal in the community should be identified, and students and other members

of the school community should follow these practices. Schools should promote methods to eliminate, conserve or recycle hazardous materials to decrease the volume of hazardous waste generated. A hazardous waste management plan should be developed to promote the identification, collection and proper disposal of all hazardous waste generated by the school.¹¹² Many schools in developed countries use mercury-containing products such as thermometers, fluorescent lamps and some batteries, possibly placing students and faculty at risk from toxic effects of mercury (mercury is toxic to the central nervous system, digestive system, kidney, liver and skin). Some communities hold annual Household Hazardous Waste Collection Days and school personnel may bring hazardous materials such as batteries and pesticides to these collection events.

Box 19: Tips for waste management in schools

- Identify hazardous and non-hazardous waste generated.
- Store hazardous wastes in a safe area located away from students.
- Inspect obsolete equipment prior to disposal for hazardous components that need to be recycled or disposed of as hazardous waste (e.g. batteries, ballasts, mercury switches, computer components, lamps).
- Develop hazardous waste management procedures and educate staff about these procedures.
- Promote methods to eliminate, reduce or recycle hazardous materials to decrease the volume of hazardous waste generated.

Students should be involved in the management of non-hazardous waste at their school to create a sense of responsibility (Box 19). Students can be involved in collecting waste in the classroom and throughout the school. They can also help to separate waste that can be composted, re-used or recycled. If a system is clearly established to manage waste, the entire school community will be a cleaner and safer environment.

Reduce use of cleaning supplies around children

Clean schools have healthier indoor air, a lower risk of spreading contagious diseases, and provide a more pleasant learning environment for both students and teachers. Adequate cleaning requires that areas of responsibility are clearly defined and understood by all members of the school community. Students should be involved in keeping their school clean to create a sense of responsibility and pride in their school environment. Skills learned in school may be carried into other environments, hopefully for many years.

Schools are easier to keep clean if properly designed. In designing a school, or in upgrading one, clean and dry pathways should lead to the entrance of the school building. If walkways are muddy, students and other visitors to the school will track in mud, dust and outdoor contaminants, increasing the amount of dust in the school and contributing to unhealthy indoor air.

Only products that are safe for use around children should be used to clean classrooms. Natural cleansers commonly perform as effectively as harsh detergents and solvents. Use alternatives to products labelled 'caution', 'warning' or 'danger' and use the minimum amount of the product recommended to complete the job.

Carefully manage the use of chemicals

Managing the use of chemicals within a school is an important issue in industrialized countries. An inventory of chemicals used and stored at school should be maintained, and teachers and staff should understand the risk associated with improperly handling and disposing these chemicals. Chemicals should be stored in a centrally located, secured and ventilated area.

In science labs, teachers should eliminate the most toxic chemicals and implement micro-scale experiments to reduce the volume of materials used or generated. The following factors should be considered when choosing a science experiment:¹¹³

- Hazards associated with the activity.
- Potential impact on indoor air quality.
- Protective equipment required.
- Generation of hazardous waste.

Art classes may be another location for chemicals. Asbestos, heavy metals, organic solvents, and other toxic ingredients have been found in some art and craft materials and may present risks to the health and safety of students using them (see Table 5). Protection from exposure to toxic materials can be achieved by:

- Safely storing and properly labelling art and craft supplies.
- Keeping dust to a minimum by damp mopping rather than sweeping.
- Thoroughly cleaning up after use of art and craft materials.
- Not allowing students to eat or drink while engaged in art projects.
- Washing hands thoroughly when finished with an art project.
- Providing proper ventilation in the art classroom.
- Premixing dry materials with water and firing ceramic products when students are away from the kiln area.

Table 5: Art and craft materials to avoid and recommended substitutes¹¹⁴

Avoid	Substitute
Products that may generate an inhalation hazard (e.g. dry clay, powdered paints, glazes, pigments, wheat paste, aerosols in spray paints or fixatives).	Wet or liquid non-aerosol products. If dry products are used, they should be mixed while children are not present.
Hazardous solvent-based products (e.g. rubber cement and its thinner, turpentine and other paint thinners, and solvent-based markers).	Water-based glues, paints, markers.
Materials that contain lead or other heavy metals (e.g. some paints, glazes, and enamels).	Products that do not contain heavy metals.
Cold water dyes or commercial dyes.	Vegetable dyes.
Instant papier-mâché, which may contain asbestos fibers, lead or other metals from pigments in coloured printing inks.	Papier-mâché made from black and white newspaper and library or white paste (or flour and water paste).

Practice safe use of pesticides

Indoor use of pesticides leaves residues that may persist long after schools are sprayed. Many nuisance problems can be controlled physically rather than chemically. Screening doors and windows and minimizing food crumbs, spills and scraps that attract insects will discourage insects from entering buildings.

Schools adjacent to farmland, golf courses, recreational areas or other land uses where pesticides are routinely applied should learn about the timing of application and keep children inside the school with windows and doors closed during periods of spraying. Schools could also encourage nearby pesticide applicators to use alternatives to pesticides.

In areas where insect-borne diseases are a problem, schools should employ integrated pest management methods, including the control of water bodies, and develop a pesticide reduction strategy (Box 20). If these measures are insufficient, the lowest-risk pesticide should be used and guidelines regarding re-entry intervals must be followed.

Box 20: A school pesticide reduction strategy

- Adopt the least toxic pest management policies and practices to reduce/eliminate pesticide use and exposure, and select the least toxic pesticides in situation where pesticide use is deemed to be essential.
- Put pest management policies in writing and make these policies public.
- If pesticides are used, schools should notify school staff, teachers, administrators, students and their parents.
- Before and after pesticides have been applied, warning signs should be posted around the treated area.
- Only certified applicators should apply pesticides at schools.
- Maintain detailed information about what pesticides are being applied, where, how, why and by whom.
- Do not use pesticides containing known or probable carcinogens for merely aesthetic purposes, such as lawn care.
- Do not spray or apply pesticides while children are in school.

Ensure safe school food services

School food services should be integrated into a school's effort to manage its environment. It could be coordinated with health and nutrition education and with other components of the health-promoting school to reinforce lessons on healthy eating and ensure nutrition support. If food is provided, the school should offer a variety of healthy food choices and promote healthy eating and food safety.¹¹⁶

Food-borne disease prevention should be a priority of school food services. Most food-borne diseases are preventable with proper food preparation and handling. It is important to educate school children and food handlers so that they can take specific measures to make food and water safe. Educating school children about food safety gives

5. INTEGRATING ENVIRONMENTAL HEALTH IMPROVEMENTS WITHIN VARIOUS COMPONENTS OF A HEALTH-PROMOTING SCHOOL

them knowledge to be selective about the foods they choose to eat. Young children in particular should therefore be taught basic rules of food safety such as washing hands before eating.¹¹⁷ Basic principles for the preparation of safe food for children are provided in Box 21.

Box 21: Basic principles for the preparation of safe food for children¹¹⁸

- Cook food thoroughly. All parts of the food must become steaming hot, reaching a minimum temperature of 70°C.
- Avoid storing cooked food.
- Avoid contact between raw ingredients and cooked foods. Cross-contamination can occur when raw foods come into contact with cooked foods or through hands, flies, utensils or unclean surfaces. Hands should be washed after handling high-risk foods such as poultry. Utensils used for raw foods should be carefully washed before they are used again for cooked foods.
- Wash foods and vegetables.
- Use safe water.
- Wash hands repeatedly.
- Protect foods from insects, rodents, and other animals.
- Store non-perishable foods in a safe place.
- Keep all food preparation premises meticulously clean.

Control hazardous vectors

If rainwater or floodwater is allowed to stand in puddles, mosquitoes and other insects may be encouraged to reproduce, leading to transmission of diseases. Accumulated waste can cause similar problems in addition to attracting flies, rodents and dogs.¹¹⁹ Modifying the environment to deprive insects and other vectors of the requirements for survival (e.g. places for breeding, resting, and feeding) will reduce contact with such organisms and create conditions less conducive to transmission of diseases such as malaria, dengue fever and schistosomiasis.¹²⁰

Locating schools away from major breeding sites and promoting and supporting the design and construction of schools to reduce contact between humans and insects or other disease-causing organisms can minimize the risk of vector-borne diseases. Incomplete schools with open walls, wide or unscreened eaves, open windows and doors and no ceilings encourage the entry of mosquitoes. Mud or unplastered walls with cracks and crevices and thatched roofs or walls also provide resting sites for mosquitoes.¹²¹

Effective malaria control has led to dramatic declines in malaria death rates in Asia. Prompt and effective treatment of malaria can reduce death rates by 50% or more.¹²² School health services can help identify and treat malaria cases in school children.

5.3 School health services

School health services help to treat health problems and to prevent, reduce and monitor them. In a health-promoting school, health services work in partnership with and are provided for students, school personnel, families and community members. School health services should be coordinated with members of the school and community to recognize and treat health problems resulting from exposure to environmental threats. These threats vary from community to community.

School nurses can help raise awareness of health problems among students, teachers and staff, and play an important role in referring students to specialists. They are responsible for "de-worming" at regular intervals, managing health outcomes such as an asthma attack or injury, and recognizing severe diseases such as malaria, severe diarrhoea and respiratory infections for correct referral. Ideally, they should receive training in environmental health issues prevalent in their community. School nurses should be responsible for tracking illnesses among students to help identify potential environmental health problems within the school.

5.4 Community and family projects and outreach

A health-promoting school should involve students, school staff, families, and community members in efforts to improve health in the school. Children who participate in efforts to create a cleaner and safer environment learn about protecting themselves and their environment, and can acquire the knowledge, attitudes, values and skills needed to adopt healthy lifestyles as adults. Family and community members can serve on the school health team or community advisory committee; participate in activities and services offered through the school such as helping to build a safe play structure for children or helping to clean up school grounds; or provide support and resources by offering financial or technical assistance to improve a school's building structure or ventilation system.

It is important for parents to understand the relationship between their child's health and their environment both at school and at home. A health-promoting school can help to educate parents about potential environmental health threats in the home. This can be accomplished at a school health fair or at a health-related workshop for parents on environmental health threats to children. In addition to learning about maintaining a healthy environment for children to thrive, parents can contribute their services or resources to the school to make improvements in the school's physical environment.

Both the school and the community can benefit from working together to create a safe physical environment at schools. For example, a school can use the services of a local company to improve its ventilation system. Parents may subsequently utilize their services to improve the indoor air quality of their own homes.

5.5 Health promotion for school staff

Health promotion and training school staff to understand and recognize the relationship between the environment and health is necessary if staff are to be positive role models for students. Additionally, well-trained school staff will be able to recognize problems in their school environment that may be contributing to poor health in both students and staff.

6. Evaluation

Evaluation provides information about the extent to which the programme is being implemented and provides feedback to those involved in project planning. Information obtained from the evaluation process can be used to make improvements in the programme, and to document experience gained from the project so it can be shared with others.

6.1 Components of evaluations

Two types of evaluation are most relevant to evaluating school health programmes: **Process evaluation** assesses how well the interventions have been taken up by schools, and identifies factors that hinder or promote their implementation. **Outcome evaluation** measures whether and to what extent objectives have been achieved, and whether the intervention has been able to influence the knowledge, attitudes and behaviour of students and staff. Outcome evaluation can demonstrate the benefits of a healthy school environment or show further need for intervention. Evaluation results can be brought to the attention of the community and can be used to convince others to become involved. Examples of topics that might be addressed in conducting the two types of evaluations are presented in Tables 6 and 7.

Table 6: Process evaluation

Basic questions	Method of measurement
Does the school have policies to improve and maintain a healthy physical environment? Are policies implemented and enforced? Do policies address all aspects of the physical environment (e.g. air, water, sanitation, waste, location, hazardous chemicals, transport, food, disease vectors)?	Interviews with school officials or programme coordinator.
Are goals and objectives well defined and do they establish criteria to measure and evaluate intervention activities and outcomes?	Interviews with school officials or programme coordinator.
Are students, teachers, school health personnel, food service personnel, parents and community members involved in the planning of interventions that are directed toward them?	Interviews with programme coordinator, school health officials, food service personnel, parents, and community representatives.
Is environmental health education integrated into the curriculum and extra-curricular activities? Is in-service training provided for educators responsible for implementing environmental health education? Do teachers feel comfortable implementing the curriculum?	Interviews with programme coordinator and teachers.
Do school health services periodically screen for environmental health problems?	Interviews with programme coordinator and school health officials.

Table 7: Outcome evaluation

Basic questions	Method of measurement
What do administrators, teachers, students, and parents think of the school's policy to improve the physical environment at schools?	Questionnaire; interviews; focus group discussions.
Has the environmental health status of the target group(s) improved?	Interview with health service providers.
What percentages of students, parents or other relevant groups have been reached by environmental health interventions?	Interviews with educators and school officials.
Does environmental health education foster the knowledge, attitudes, beliefs, and skills needed to adopt healthy behaviours or create conditions conducive to health?	Questionnaire; interviews; focus group discussions.

Frequently used methods of evaluation include classroom discussions, questionnaires, focus groups, observations, and interviews. Medical screenings provide measurements of specific health indicators such as asthma or respiratory infections, and oral or written tests can provide information on educational achievements.

6.2 Reporting progress and achievements

An evaluation is complete when its results are reported and communicated to those responsible for managing the school environment. Evaluation reports could be designed to contain interesting and easily understandable material for many individuals and groups. Evaluation results can be used as a basis for discussion to develop further and support efforts to improve the physical environment of schools.

Examples of educational strategies to promote environmental health

Health is missing from the curriculum of many schools. Environmental health may be incorporated within curriculum units of any discipline including: history, science, mathematics, geography, social studies, literature, art, etc. Although it is not the purpose of this document to develop or present curricula, the following topical examples might be adapted to grade level and subject matter.

Environmental health

- Explain how specific illnesses are related to poor environmental quality.
- Identify key environmental threats to health within your school and community. Older students could compare threats among nations, and different regions of their country.

Air

- Identify possible sources of indoor air pollution.
- Identify sources of air pollution within schools. These could include wood smoke cooking fumes, pesticides, and volatile chemicals.
- Discuss practical options to improve air quality within the school.
- Identify sources of air pollution within the community. These might include: motor vehicles, industrial activity, construction equipment, and agricultural practices.
- Consider how pollution levels might be reduced, or how exposure may be minimized.
- Explore how pollution may vary by time of day.
- Research whether indoor air is cleaner than outdoor air, and the implications for ventilation.
- Keep track of rates of respiratory illness within the school through the year. Use this as an opportunity to teach mathematics and graphing of data.

Water

- Identify sources of water in the community.
- Identify contaminants that may threaten the local water supply.
- Explore how land use practices may affect water quality in your community.
- Discuss ways to keep the water supply safe from dirt, bacteria, parasites, or other contaminants that could make the water supply unhealthy.
- Explore ways of promoting safe water storage and disinfection practices in the home.
- Research how human illness may be related to water pollution.
- Have older students design a water quality sampling strategy that would capture different types of pollution, and its variability throughout the year.
- Keep track of the use of pesticides within your community, and learn about the potential of pesticides to contaminate water supplies.

Food

- Discuss types of food contamination in the community including the possibility of contamination by human or animal waste, manure, pesticides used on crops, or other chemicals accidentally or intentionally added to the local food supply.
- Have older students design, conduct and analyze a dietary survey.
- Explore how dietary patterns among students compare with recommended nutritional guidelines.
- Identify the sources of all foods and drinks consumed during a single day or meal.
- Discuss proper food handling procedures.

Waste

- Discuss types of wastes generated in the community, categories may include: chemical waste (pesticides, industrial waste), solid waste (household trash), and liquid waste (animal/human urine, feces, waste water).
- Identify common practices of disposing waste, including excreta, in the community.
- Discuss risks associated with improper waste disposal.
- Younger children could make posters showing different types of waste in the community and how they should be disposed.

Disease vectors

- Students can identify key disease vectors in their community (mosquitoes, ticks, worms, rodents, etc.).
- Have local vector-borne diseases become a curriculum unit within science classes to study vector behaviour, reproduction, habitat requirements, and the lifecycle of the illness in humans and other species.
- Identify ways students may be exposed to vectors. Have older students research diseases associated with vectors using available research methods.
- Discuss methods to reduce vector populations. Organize efforts to reduce the vector population, such as clearing brush away from the school.

Hazardous materials

Older students can:

- Develop an inventory of hazardous substances on school properties. These may include pesticides, fuels, solvents, some cleansers, paints and wall finishes.
- Explore how use of these substances could be reduced, and search for less toxic substitutes to meet intended purposes.
- Research proper containment, storage and disposal practices to minimize the potential for human exposure and illness.

Transit and transport

Older students can:

- Develop a transportation inventory for the school.
- Document the methods of transit between home and schools for students and staff.
- Examine vehicle use, distance travelled, fuels consumed, and idling behaviour of vehicles.
- Identify accidents associated with transport by type, severity, location and outcome.
- Evaluate routing and control alternatives to reduce vehicle-pedestrian and vehicle-bicycle conflicts.

- 1 Ottawa Charter for Health Promotion. First International Conference on Health Promotion, Ottawa, 21 November 1986. Available at http://www.who.int/hpr/NPH/docs/ottawa_charter_hp.pdf (This reference has provided the general approach on which this document is based and is applied to all sections of this document without specifically being referenced.).
- 2 WHO. Healthy Nutrition: an Essential Element of a Health-Promoting School. WHO Information Series on School Health. Geneva: WHO, 1998. (This document has been used as a model in developing this report and is quoted without specifically being referenced. Other documents in this series were also referred to in the development of this report without specifically being referenced).
- 3 WHO. School Health and Youth Health Promotion. Available at <http://www.who.int/hpr/gshi/index.htm>.
- 4 American Academy of Pediatrics. Committee on School Health, School Health Policy and Practice, Fifth Edition, 1993.
- 5 Ottawa Charter for Health Promotion. First International Conference on Health Promotion, Ottawa, 21 November 1986. Available at http://www.who.int/hpr/NPH/docs/ottawa_charter_hp.pdf.
- 6 Based on EIP/WHO. Mortality Data 2000, version 2 (unpublished).
- 7 Smith et al. How much global ill health is attributable to environmental factors? *Epidemiology* 10(5):573-584, 1999.
- 8 WHO. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002.
- 9 WHO. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002.
- 10 WHO. Health and Environment in Sustainable Development. Five Years after the Earth Summit. Geneva: WHO, 1997.
- 11 WHO. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002.
- 12 WHO. Health and Environment in Sustainable Development. Five years after the Earth Summit. Geneva: WHO, 1997.
- 13 World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. 1998-99 World Resources: A Guide to the Global Environment. Oxford: Oxford University Press, 1998.
- 14 Cairncross S, Curtis V. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *The Lancet Infectious Diseases* 3(5):275-81, 2003.
- 15 Martines J et al. Diarrheal Diseases. In: Disease Control Priorities in Developing Countries, DT Jamison, H Mosley, A Measham et al. (eds.). Oxford: Oxford Medical Publications, 1993.
- 16 International Life Sciences Institute. Global approach to prevent, detect, and treat food-borne disease. ILSO News Vol. 15 No. 2 (March/April 1997). In: World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. 1998-99 World Resources: A Guide to the Global Environment. Oxford: Oxford University Press, 1998.
- 17 WHO. World Health Report 1996: Fighting Disease, Fostering Development. Geneva: WHO, 1996.
- 18 WHO. Vectors of Diseases, Hazards and Risks for Travellers Part 1. *Weekly Epidemiological Review* 25(76):189-196, 2001.
- 19 WHO. Roll Back Malaria: Increasing the Momentum. Fact Sheet. Available at www.who.int/inf.fs/en/fact203.html.
- 20 WHO. Malaria – a Global Crisis. Fact Sheet. Available at www.who.int/inf.fs/en/fact203.html.
- 21 WHO. World Health Report 1996: Fighting Disease, Fostering Development. Geneva: WHO, 1996.
- 22 Gubler D, Clark G. Community involvement in the control of *Aedes aegypti*. *Acta Tropica* 61(2):169-79, 1996.
- 23 Harvard School of Public Health. How the World Dies Today. The Global Burden of Disease and Injury Series, Burden of Disease Unit, Center for Population and Development Studies. Available at www.hsph.harvard.edu/organizations/bdu/GBDseries.html.
- 24 WHO. Healthy Environments for Children: Initiating an Alliance for Action. Geneva: WHO, 2002.

- 25 Adapted from: Pesticide Action Network, United Kingdom. Press Release. 10/30/2001. Available at www.pan-uk.org/pestnews/pn46/pn46p3.htm.
- 26 WHO. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002.
- 27 Lichtenstein P, Holm NV, Verkasalo PK, et al. Environmental and heritable factors in the causation of cancer - analyses of cohorts of twins from Sweden, Denmark, and Finland. *New England Journal of Medicine* 343(2):78-85, 2000.
- 28 Zahm SH, Devesa SS. Childhood cancer: overview of incidence trends and environmental carcinogens. *Environmental Health Perspectives* 103 Supplement 6:177-84, 1995.
- 29 Committee on Environmental Health, American Academy of Pediatrics. *Handbook of Pediatric Environmental Health*. Elk Grove, 1999.
- 30 Ries LAG, Smith MA, Gurney JG, et al. (eds). *Cancer incidence and survival among children and adolescents: United States SEER program 1975-1996*, National Cancer Institute, SEER Program. N 99-4649. Bethesda: National Institutes of Health, 1999.
- 31 Committee on Environmental Health, American Academy of Pediatrics. *Handbook of Pediatric Environmental Health*. Elk Grove, 1999.
- 32 WHO. International Consultation on Environmental Tobacco Smoke and Child Health. 11-14 January 1999. Consultation report (excerpts).
- 33 Ries LAG, Smith MA, Gurney JG, et al. (eds). *Cancer incidence and survival among children and adolescents: United States SEER program 1975-1996*, National Cancer Institute, SEER Program. N 99-4649. Bethesda: National Institutes of Health, 1999.
- 34 McBride ML. Childhood cancer and environmental contaminants. *Canadian Journal of Public Health, Supplement* 1:S53-62,S58-68, 1998.
- 35 Zahm SH, Devesa SS. Childhood cancer: overview of incidence trends and environmental carcinogens. *Environmental Health Perspectives* 103 Supplement 6:177-84, 1995.
- 36 Oberhelman RA, Guerrero ES, Fernandez ML, et al. Correlations between intestinal parasitosis, physical growth, and psychomotor development among infants and children from rural Nicaragua. *American Journal of Tropical Medicine and Hygiene* 58(4):470-5, 1998.
- 37 Oberhelman RA, Guerrero ES, Fernandez ML, et al. Correlations between intestinal parasitosis, physical growth, and psychomotor development among infants and children from rural Nicaragua. *American Journal of Tropical Medicine and Hygiene* 58(4):470-5, 1998.
- 38 Agarwal KN, Agarwal DK, Upadhyay SK. Impact of chronic undernutrition on higher mental functions in Indian boys aged 10-12 years. *Acta Paediatrica* 84(12):1357-61, 1995.
- 39 UNICEF. The state of the world's children 2002. Available at <http://www.unicef.org/sowc02/brief1.htm>.
- 40 WHO. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002.
- 41 World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. 1998-99 World Resources: A Guide to the Global Environment. Oxford: Oxford University Press, 1998.
- 42 Alliance to End Childhood Lead Poisoning. International Action Plan for Preventing Lead Poisoning, 3rd Edition. 2001. Available at www.globalleadnet.org/policy_leg/policy/intlactionplan.cfm.
- 43 Centers for Disease Control and Prevention. Developmental disabilities. Available at <http://www.cdc.gov/nceh/cddh/ddhome.htm>.
- 44 United States National Academy of Sciences. Scientific frontiers in developmental toxicology and risk assessment. June 2000. Available at <http://www.nap.edu/books/0309070864/html/>.
- 45 Centers for Disease Control and Prevention. CDC's lead poisoning and prevention program. September 2001. Available at <http://www.cdc.gov/nceh/lead/factsheets/leadfacts.htm>.
- 46 Agency for Toxic Substances and Disease Registry. Public health statement for mercury. March 1999. Available at <http://www.atsdr.cdc.gov/ToxProfiles/phs8916.html>.
- 47 Baker EL Jr, Smith TJ, Landrigan PJ. The neurotoxicity of industrial solvents: a review of the literature. *American Journal of Industrial Medicine* 8(3):207-17, 1985.
- 48 Tilson HA, Kodavanti PR. Neurochemical effects of polychlorinated biphenyls: an overview and identification of research needs. *Neurotoxicology* 18(3):727-43, 1997.

- 49 Schettler T. et al. In harm's way: toxic threats to child development. A report by the Greater Boston Physicians for Social Responsibility, 2000.
- 50 Wargo J. Our children's toxic legacy. New Haven: Yale Press, 1998. See also: National Academy Press. Pesticides in the diets of infants and children, 1993, and: www.epa.gov/pesticides/cumulative.
- 51 Aubier M. Air pollution and allergic asthma. *Revue des Maladies Respiratoires* 17(1 Pt 2):159-65, 2000.
- 52 Yang KD. Childhood asthma: aspects of global environment, genetics and management. *Changeng Yi Xue Za Zhi* 23(11):641-61, 2000.
- 53 Centers for Disease Control and Prevention. CDC's asthma prevention program. Available at <http://www.cdc.gov/nceh/asthma/factsheets/asthma.htm>.
- 54 Centers for Disease Control and Prevention. Measuring childhood prevalence before and after the 1997 redesign of the National Health Interview Survey. *United States Morbidity and Mortality Weekly Report* Vol. 49(40): 908-911, October 2000.
- 55 Aligne C, Auinger P, Byrd RS, Weitzman M. Risk factors for pediatric asthma. Contributions of poverty, race, and urban residence. *American Journal of Respiratory and Critical Care Medicine* 162(3 Pt 1):873-7, 2000.
- 56 Crain EF, Weiss KB, Bijur PE, et al. An estimate of the prevalence of asthma and wheezing among inner-city children. *Pediatrics* 94(3):356-62, 1994.
- 57 Claudio L, Torres T, Sanjurjo E, et al. Environmental health sciences education - a tool for achieving environmental equity and protecting children. *Environmental Health Perspectives* 106, Supplement 3:849-55, 1998.
- 58 Adapted from: American Medical Association. In: United States Environmental Protection Agency. Asthma and upper respiratory illnesses. Office of Children's Health Protection. Available at www.epa.gov/children/asthma.htm.
- 59 Smith et al. How much global ill health is attributable to environmental factors? *Epidemiology* 10(5):573-584, 1999.
- 60 World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. 1998-99 World Resources: A Guide to the Global Environment. Oxford: Oxford University Press, 1998.
- 61 WHO. Children's environmental health. Available at http://www.who.int/phe/health_topics/children/en/index.html.
- 62 WHO. Global water supply and sanitation assessment 2000. Geneva: WHO, 2000.
- 63 WHO. Global water supply and sanitation assessment 2000. Geneva: WHO, 2000.
- 64 United States Environmental Protection Agency. Indoor air quality and student performance. EPA 402-F-00-009, 2000.
- 65 United States Environmental Protection Agency. What are Air Pollutants? 2001. Available at <http://www.epa.gov/region01/eco/iaq/airpollu.html>.
- 66 United States Government Accounting Office. School facilities: the condition of America's schools. GAO Report HEHS-95-61, 1995.
- 67 Wakefield, J. Learning the hard way: the poor environment of America's schools. *Environmental Health Perspectives* 110 (6):A298-305, 2002.
- 68 Committee on Environmental Health, American Academy of Pediatrics. Handbook of Pediatric Environmental Health. Elk Grove, 1999.
- 69 WHO. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002.
- 70 World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. 1998-99 World Resources: A Guide to the Global Environment. Oxford: Oxford University Press, 1998.
- 71 WHO. Let every person breathe. World Asthma Day. Fact Sheet. Available at <http://www.who.int/inf-pr-2000/en/pr2000-29.html>.
- 72 WHO. Bronchial Asthma. Fact Sheet. Revised January 2000. Available at www.who.int/inf-fs/en/fact206.html.

- 73 National Intelligence Council, Director Central Intelligence Environmental Center. Russia and the environment: a general overview of environmental issues, 1999.
- 74 World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. 1998-99 World Resources: A Guide to the Global Environment. Oxford: Oxford University Press, 1998.
- 75 WHO. Guidelines for Air Quality. Geneva: WHO, 2000.
- 76 United States Environmental Protection Agency. The EPA children's environmental health year book 1998. Office of Children's Health Protection, EPA 100-R-98-100, 1998.
- 77 Yu O, Sheppard L, Lumley T, et al. Effects of ambient air pollution on symptoms of asthma in Seattle-area children enrolled in the CAMP study. *Environmental Health Perspectives* 108(12):1209-14, 2000.
- 78 Stern RS, Weinstein MC, Baker SG. Risk reduction for non-melanoma skin cancer with childhood sunscreen use. *Archives of Dermatology* 122(5):537-45, 1986.
- 79 Zahm SH, Ward MH. Pesticides and childhood cancer. *Environmental Health Perspectives* 106 Supplement 3:893-908, 1998.
- 80 Meinert R, Schuz J, Kaletsch U, et al. Leukemia and non-Hodgkin's lymphoma in childhood and exposure to pesticides: results of a register-based case-control study in Germany. *American Journal of Epidemiology* 151(7):639-46; Discussion 647-50, 2000.
- 81 Buckley JD, Meadows AT, Kadin ME, et al. Pesticide exposure in children with non-Hodgkin's lymphoma. *Cancer* 89(11):2315-21, 2000.
- 82 WHO. Primary School Physical Environment and Health. Geneva: WHO, 1997.
- 83 Wargo J, Brown D. Pesticide use in Connecticut schools. New Haven: Environment and Human Health Inc, 2002.
- 84 WHO. Food-borne Disease: a Focus for Health Education. Geneva: WHO, 2000.
- 85 WHO. Food-borne Disease: a Focus for Health Education. Geneva: WHO, 2000.
- 86 WHO. Food-borne Disease: a Focus for Health Education. Geneva: WHO, 2000.
- 87 WHO. Food-borne Disease: a Focus for Health Education. Geneva: WHO, 2000.
- 88 Helfand D, Moore S. Schools: Experts say completing the campus could cost \$80 million more, and that the facility can be made safe. *Los Angeles Times*. 8 February 2002.
- 89 Evans D, Clark NM, Levison MJ, et al. Can children teach their parents about asthma? *Health Education and Behaviour* 28(4):500-11, 2001.
- 90 UNICEF. The state of the world's children 2002. Available at <http://www.unicef.org/sowc02/brief7.htm>.
- 91 Centers for Disease Control and Prevention. Asthma – general information. Available at <http://www.cdc.gov/nceh/airpollution/asthma/basics.htm>
- 92 WHO. Local Action: Creating Health-Promoting Schools. WHO Information Series on School Health. Geneva: WHO, 2000. Available at http://www.who.int/school_youth_health/media/en/88.pdf.
- 93 WHO. Food, Environment and Health. A Guide for Primary School Teachers. Geneva: WHO, 1990. The United States Environmental Protection Agency provides ideas for teaching pollution prevention in schools at http://www.epa.gov/teachers/curriculum_resources.htm.
- 94 WHO. Skills for Health, Skills-Based Health Education including Life Skills: an Important Component of a Child Friendly/Health-Promoting School. Geneva: WHO, 2003. Available at http://www.who.int/school_youth_health/resources/en/.
- 95 Hart R. Children's participation: the theory and practice of involving young citizens in community development and environmental care. UNICEF. Earthscan Publications Ltd, 1997.
- 96 The Child-to-Child Trust. Available at www.child-to-child.org/about/approach.html.
- 97 The Child-to-Child Trust. Available at www.child-to-child.org/about/approach.html.
- 98 WHO. Primary School Physical Environment and Health. Geneva: WHO, 1997.
- 99 WHO. Strengthening Interventions to Reduce Helminth Infections. WHO Information Series on School Health. Available at <http://www.who.int/hpr/gshi/helminths.pdf> and *Helminth Control in School-Age Children: a Guide for Managers of Control Programmes*. Geneva: WHO, 2002.
- 100 United States Department of Health and Human Services. Preventing lead poisoning in young children. October 1991. Available at <http://aepo-xdv-www.epo.cdc.gov/wonder/prevguid/p0000029/p0000029.asp>.

- 101 WHO. Primary School Physical Environment and Health. Geneva: WHO, 1997.
- 102 WHO. Primary School Physical Environment and Health. Geneva: WHO, 1997.
- 103 WHO. Tobacco – Health Facts. Fact Sheet. Available at: <http://www.who.int/inf-fs/en/fact221.html>.
- 104 Adapted from WHO. Tobacco Use Prevention: An Important Entry Point for the Development of Health Promoting Schools. WHO Information Series on School Health. Geneva: WHO, 1998.
- 105 United States Department of Energy. Causes of indoor air quality problems in schools. Summary of scientific research. Revised Edition. 2000. Available at: <http://www.eere.energy.gov/buildings/documents/pdfs/iaq-rpt.pdf>.
- 106 Adapted from: United States Environmental Protection Agency. Mold remediation in schools and commercial buildings, 2001. Available at <http://www.epa.gov/iaq/molds/prevention.html>.
- 107 United States Environmental Protection Agency. The EPA children's environmental health year book 1998. Office of Children's Health Protection, EPA 100-R-98-100, 1998.
- 108 McConnell R, Berhane K, Gilliland F, et al. Asthma in exercising children exposed to ozone. *The Lancet* 359(9304):386-91, 2002.
- 109 WHO. Promoting Active Living in and through Schools. Policy Statement and Guidelines for Action. Geneva: WHO, 1998.
- 110 WHO. Sun Protection: an Essential Element of a Health-Promoting School. WHO Information Series on School Health. Geneva: WHO, 2001.
- 111 Dresser, T. A case study of environmental, health and safety issues involving the Burlington, Massachusetts public school system. United States Environmental Protection Agency, Region 7. Available at <http://www.epa.gov/region07/kids/dresser9.htm>.
- 112 Dresser T. A case study of environmental, health and safety issues involving the Burlington, Massachusetts public school system. United States Environmental Protection Agency, Region 7. Available at <http://www.epa.gov/region07/kids/dresser9.htm>.
- 113 Dresser T. A case study of environmental, health and safety issues involving the Burlington, Massachusetts public school system. United States Environmental Protection Agency, Region 7. Available at <http://www.epa.gov/region07/kids/dresser9.htm>.
- 114 Adapted from: Office of Environmental Health Hazard Assessment. Guidelines for the safe use of art and craft materials. California, 2002. Available at <http://www.oehha.org/education/art/artguide.html>.
- 115 Adapted from: Attorney General of New York. Pesticides in schools: reducing the risks (Revised). New York State, Department of Law, Environmental Protection Bureau, 1996.
- 116 WHO's advice for developing national or regional dietary guidelines for children. Available at: <http://www.who.int/hpr/nutrition>. Current advice is based on the Report of the Joint WHO/Food and Agricultural Organization Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases, (2002). Additional information about nutrition, food services and the physical environment is available in Healthy Nutrition: An Essential Element of a Health-Promoting School. WHO Information Series on School Health. Available at: <http://www.who.int/hpr/gshi/nutri.pdf>.
- 117 WHO. Food-borne Disease: a Focus for Health Education. Geneva: WHO, 2000.
- 118 WHO. Basic principles for the safe preparation of safe food for infants and young children. Geneva: WHO, 1996. In: WHO. Food-borne Disease: a Focus for Health Education. Geneva: WHO, 2000.
- 119 WHO. Primary School Physical Environment and Health. Geneva: WHO, 1997.
- 120 WHO. Vector control for malaria and other mosquito-borne diseases. Report of a WHO study group. Geneva: WHO, 1995.
- 121 WHO. Vector control for malaria and other mosquito-borne diseases. Report of a WHO study group. Geneva: WHO, 1995.
- 122 WHO. Roll Back Malaria: Increasing the Momentum. Fact Sheet. Available at www.who.int/inf.fs/en/fact203.html.

This document is part of the **WHO Information Series on School Health**. Each document in this series provides arguments that can be used to gain support for addressing important health issues in schools. The documents illustrate how selected health issues can serve as entry points in planning, implementing, and evaluating health interventions as part of the development of a Health-Promoting School.

Other documents in this series include:

- Local Action: Creating Health-Promoting Schools (WHO/NMH/HPS/00.4)
- Strengthening Interventions to Reduce Helminth Infections: An Entry Point for the Development of Health-Promoting Schools (WHO/HPR/HEP/96.10)
- Violence Prevention: An Important Element of a Health-Promoting School (WHO/HPR/HEP/98.2)
- Healthy Nutrition: An Essential Element of a Health-Promoting School (WHO/HPR/HEP/98.3)
- Tobacco Use Prevention: An Important Entry Point for the Development of a Health-Promoting School (WHO/HPR/HEP/98.5)
- Preventing HIV/AIDS/STI and Related Discrimination: An Important Responsibility of Health-Promoting Schools (WHO/HPR/HEP/98.6)
- Sun Protection: An Important Element of a Health-Promoting School (WHO/PHE and WHO/NPH, 2002)
- Creating an Environment for Emotional and Social Well-Being: An Important Responsibility for a Health-Promoting and Child-Friendly School (WHO/MNH and WHO/NPH, 2003)
- Skills for Health: Skills-Based Health Education Including Life Skills (WHO and UNICEF, 2003)
- Family Life, Reproductive Health and Population Education: Key Elements of a Health-Promoting School (WHO/NPH, 2003)
- The Physical School Environment: An Essential Component of a Health-Promoting School (WHO/PHE and WHO/NPH, 2004)

Documents can be downloaded from the Internet site of the WHO Global School Health Initiative (www.who.int/school-youth-health) or requested in print by contacting the School Health/Youth Health Promotion Unit, Department of Noncommunicable Disease Prevention and Health Promotion, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland, Fax: (+41 22) 791-4186.

In an effort to provide you with the most useful and user-friendly material, we would appreciate your comments:

- *From where did you receive this document, and how did you hear about it?*
- *Did you find this document useful for your work? Why or why not?*
- *What do you like about this document? What would you change?*
- *Do you have other comments on any aspect of this document, for example, its content, design, or user-friendliness?*

Please send your feedback to:

School Health/Youth Health Promotion Unit
Department of Noncommunicable Disease Prevention and Health Promotion
World Health Organization
20 Avenue Appia
1211 Geneva 27
Switzerland

Thank you. We look forward to hearing from you.