



Using Indicators to Measure Progress on Children's Environmental Health

A CALL TO ACTION





“The challenge before us now is to . . . emerge ten years from now having addressed the linkages between children’s health and the environment in a meaningful and measurable way. In ten years the children on this planet should be healthier and happier as a result of the decisions and actions we all take today. **”**

— *Children in the New Millennium:
Environmental Impact on Health, 2002*

FOREWORD BY

Klaus Töpfer, Executive Director, UNEP

Carol Bellamy, Executive Director, UNICEF

Gro Harlem Brundtland, Director General, WHO

A Call to Action

CHILDREN ARE OUR FUTURE, numbering over 1.6 billion worldwide and representing boundless potential. Child survival hinges on basic needs to support life; among these, a safe and healthy environment is fundamental. However, children everywhere are negatively affected by adverse environmental conditions.

- ▶ Each year, at least 3 million children under the age of five die due to environment-related illnesses.¹
- ▶ Acute respiratory infections annually kill an estimated 2 million children under the age of 15.² As much as 60 percent of acute respiratory infections worldwide are related to environmental conditions.³
- ▶ Diarrheal diseases claim the lives of nearly 2 million

children every year.⁴ Eighty to 90 percent of these diarrhea cases are related to environmental conditions, in particular, contaminated water and inadequate sanitation.⁵

- ▶ More than 1 million children under the age of 15 died of malaria in 1998.⁶ Ninety percent of malaria cases are attributed to environmental factors.⁷

The world pays a heavy toll for children's poor environmental health: medical expenses, sick days away from school, productivity lost by parents missing work to care for their children, and the personal agony that childhood sickness and death costs children, parents, families, and communities.

We call on governments, non-governmental organizations, inter-governmental organizations, the private sector, communities, and UN agencies to work together to protect children from environmental threats. One key step is to develop and use children's environmental health indicators.



Why A Global Effort?

INDICATORS GIVE COUNTRIES a credible and useful way to assess the status of children's environmental health and to monitor the success or failure of interventions to address the problems. Thus, policy-makers are better positioned to improve conditions for children. Children are 100 percent of the world's future, and by addressing the problems that face the youngest members of society, governments improve the health of generations to come.

While several countries and regions have begun to develop indicators of children's environmental health, a coordinated international effort would be cost-effective, would allow nations to work together and learn from each other, and would enable the international community to develop and construct further actions to

protect children's environmental health.

Central to the concept of sustainable development is the capacity of children to sustain, build, and improve the societies they inherit. Healthy children learn better and are able to lead more productive lives, creating a strong base on which an economy can grow and society can prosper. Alone, indicators will not solve all the urgent problems facing children around the globe. But they will provide an important tool to policy-makers, enabling them to make better decisions and design effective interventions that will protect children from the many environmental health threats they currently face (see page 4).

Measuring Progress toward Goals

Children's environmental health is intrinsically connected to a number of the broad goals adopted in the 2000 United Nations Millennium Declaration. For example, the goal to reduce the under-five mortality rate by two thirds between 1990 and 2015 depends largely on drastic reductions in the top two causes of child mortality—diarrhea and acute respiratory infections.

Children's environmental health

indicators can be likened to economic indicators—such as gross domestic product or the unemployment rate—that give a sense of how well the economy is doing. Children's environmental health indicators help to fill the gaps between information on environment and information on health, putting into focus the special vulnerabilities of children in order to guide environmental, health, and development policy.

Why Children's Environmental Health Indicators?

CHILDREN'S ENVIRONMENTAL health indicators are effective tools for:⁸

- ▶ Understanding the status of children's environmental health in countries;
- ▶ Monitoring trends in the environment, in order to identify potential risks to health;
- ▶ Monitoring trends in health resulting from exposures to environmental hazards;
- ▶ Investigating potential connections between environmental conditions and health outcomes;
- ▶ Raising awareness about environmental health issues across stake-holder groups;
- ▶ Producing data to establish baselines, share best practices, and measure progress toward stated goals;
- ▶ Informing policy making at all levels of government;
- ▶ Targeting actions where they are most needed.

Why Focus on Children?

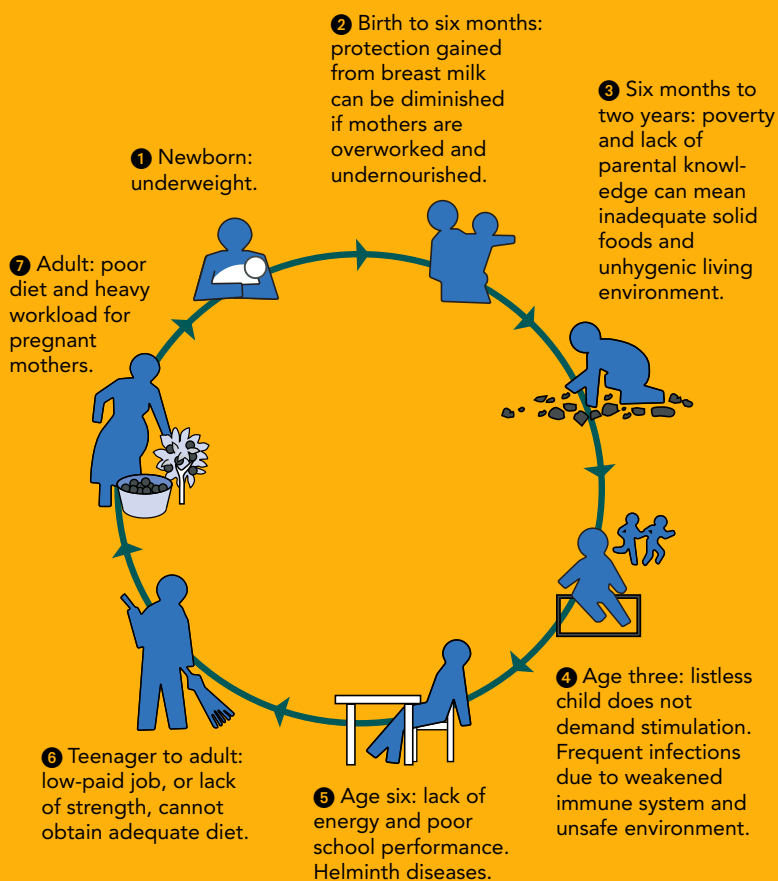
CHILDREN ARE MORE vulnerable than adults to environmental risks because of a number of factors.

- ▶ Children are constantly growing. They breathe more air, consume more food, and drink more water than adults do, in proportion to their weight.⁹
- ▶ Children's central nervous, immune, reproductive, and digestive systems are still developing. At certain early stages of development, exposure to environmental toxins can lead to irreversible damage.¹⁰
- ▶ Children behave differently from adults and have different patterns of exposure. Young children crawl on the ground where they can be exposed to dust and chemicals that accumulate on floors and soil.
- ▶ Children have little control over their environment. Unlike adults, they may be both unaware of risks and unable to make choices to protect their health.



THE CYCLE OF ENVIRONMENTAL DISEASE

The cycle of malnutrition, infection, and malnutrition pushes children down the spiral of poor growth and early death. Environmental management strategies can help prevent this vicious spiral.¹¹



“We recognize that a growing number of diseases in children have been linked to environmental exposures. . . and that more and more children are being exposed to unsafe environments where they are conceived and born, where they live, learn, play, work and grow.”

— The Bangkok Statement, International Conference on Environmental Threats to the Health of Children in South East Asia and Western Pacific Countries, Thailand, March 2002 (WHO and Chulabhorn Research Institute)

What Are Key Children's Environmental Health Problems?

While industrialized countries grapple with asthma, developmental disorders, and childhood exposure to chemicals and toxic substances, developing countries face these problems plus the added burden of basic development issues such as: access to safe drinking water, adequate housing, and sanitation facilities; vector-borne disease; and adequate and nutritious food supply. In developing countries, acute respiratory infections and diarrheal disease are the leading causes of under-five mortality. Other key children's environmental health problems around the world include:

Environmental Exposures

- Chemicals and pesticides
- Heavy metals, including lead and mercury
- Inadequate housing
- Indoor and outdoor air pollution
- Natural hazards
- Noise
- Persistent Organic Pollutants
- Poor sanitation and hygiene
- Poor water quality and quantity
- Radiation
- Road traffic
- Solid waste
- Unsafe food
- Vector-borne disease

Health Outcomes

- Accidents and injuries
- Birth defects and perinatal conditions
- Cancers and tumors
- Circulatory diseases
- Diarrheal diseases
- Endocrine disruption
- Eye and ear diseases
- Mental and behavioral disorders
- Nutritional disorders
- Other infectious and parasitic diseases
- Poisonings
- Reproductive system disorders
- Respiratory diseases
- Tuberculosis

Why Link Environment and Health?

PROTECTING ENVIRONMENTAL health requires that we better understand the relationship between *environmental conditions* and *health outcomes*. Medical treatment alone is not a sustainable public health policy if environmental exposures that are associated with illnesses are not also addressed and prevented. Coordination between the environmental and health sectors broadens the scope of information available to identify and implement prevention strategies.

Water Quality, Diarrhea, and Oral Rehydration Therapy

To understand why the relationships between environment and health are crucial, consider the significant progress achieved in the treatment of childhood

diarrhea through oral rehydration therapy (ORT). ORT counteracts the deadly loss of the body's water and electrolytes caused by diarrhea with a simple rehydration formula. It is estimated that ORT is now saving more than 1 million children each year from death due to diarrheal dehydration.¹² Nevertheless, while ORT controls the ravages of diarrhea, it does not prevent the illness. No matter how effective ORT is as a treatment, children who return to the same unsafe environments are likely to contract diarrhea again. Without increased access to sufficient amounts of clean water and sanitation, and without changes in hygiene and behavior, children will continue to get sick and will be progressively weakened by multiple episodes of diarrhea each year.



A Simple Model of Children's Environmental Health Indicators

MANY MODELS OF environmental health indicators exist. A simple model appears below.¹³ This model recognizes three components that are needed to assess a particular environmental health problem and the interventions used to address it:

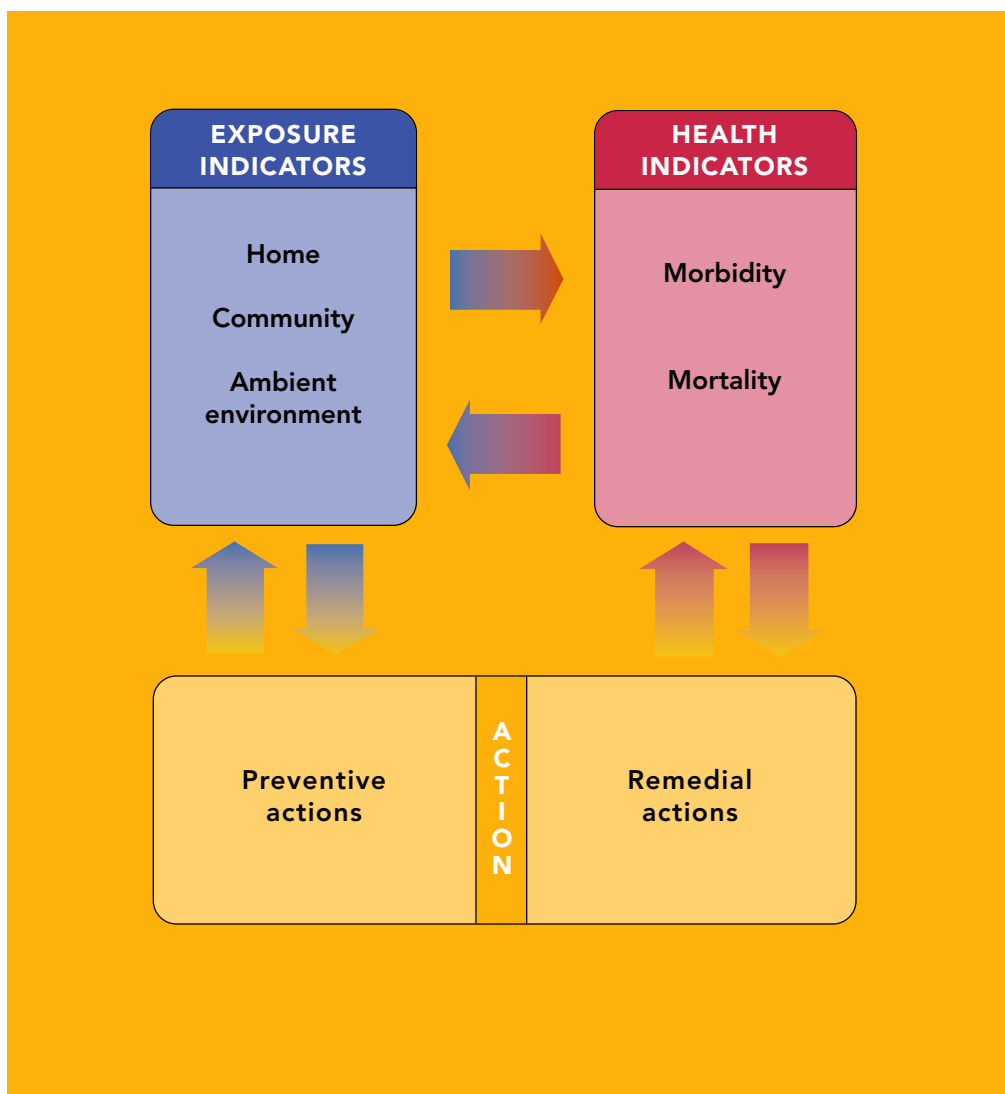
- ▶ Indicators that relate to environment and exposure;
- ▶ Indicators that relate to health outcomes; and,
- ▶ Actions that might be taken to reduce risks to child health.

The model shows that one health problem can be linked to more than one environmental exposure, and an individual exposure can result in a number of different health outcomes.

Indicators inform decision-makers and assist them in taking appropriate action. Actions to solve the problem in question may take many forms and be either preventive or remedial. Preventive actions are usually directed at the environmental exposure and remedial actions are directed at the health outcome. In the case of childhood diarrhea, an example of a preventive action would be to improve drinking water sources, and one proven remedial action is oral rehydration therapy.

For the purpose of long-term improvement of children's environmental health, preventive actions are preferable to remedial ones, although remedial actions provide necessary short-term solutions.

The following pages illustrate how this model helps to frame two common children's environmental health problems: respiratory illness and childhood diarrhea.



Air Pollution and Respiratory Illness



ENVIRONMENT AND EXPOSURE:

Air pollution, both indoor and outdoor, is a primary environmental health threat to children.

Approximately 2.5 billion people worldwide rely on biomass fuels and coal for cooking and heating needs.¹⁴ In crowded and poorly ventilated settings,

these fuels lead to dangerously high levels of indoor air pollution. Another important source of indoor air pollution is tobacco smoke. Outdoor air pollutants such as particulate matter and ozone are additional exposure risks to children, especially in urban settings.

HEALTH OUTCOMES:

Acute respiratory infections, (ARIs) such as pneumonia, kill approximately 2 million children annually.¹⁵ As much as 60 percent of ARIs worldwide are related to environmental conditions.¹⁶ Exposure to tobacco smoke is tied to both chronic and acute respiratory illnesses. Indoor air pollution from open fires and inefficient stoves is the single greatest cause of ill health from all forms of air pollution worldwide.¹⁷ Outdoor air pollutants can exacerbate both asthma and ARI in children.

ACTIONS:

Exposure sources, preventive interventions and the commitment of resources are likely to differ by country and location. Major differences may exist between rural and urban poor populations. Effective measures (for example well ventilated, fuel-efficient stoves) are needed to lessen the burden of ARI and asthma.

Developing Indicators as a Policy Tool—Using ARI as an Example

A country is concerned about the status of its children's health, specifically acute respiratory infections and their known association with indoor air pollution. Children's environmental health indicators would help

guide the collection of necessary data and strengthen the information needed for taking appropriate action. Indicators could also be used to evaluate the impact of interventions.

ENVIRONMENT & EXPOSURE

- How many children are exposed to indoor air pollution from the use of biomass fuels and coal?
- Where do these children live and under what conditions?



HEALTH OUTCOMES

- What are the acute respiratory infection morbidity and mortality rates for children?



preventive:

- Provide public education
- Improve ventilation in housing
- Use fuel-efficient stoves
- Invest in energy infrastructure
- Use clean fuels
- Eliminate smoking indoors

ACTIONS

remedial:

- Provide access to medical treatment and facilities
- Use antibiotics and other treatment medications as appropriate

Unsafe Drinking Water & Childhood Diarrhea

ENVIRONMENT AND EXPOSURE:

Childhood diarrhea is closely associated with insufficient water supply, inadequate sanitation, water contaminated with communicable disease agents, and poor hygiene practices.

Approximately 1.1 billion people do not have access to clean and safe water supplies,¹⁸ and about 2.4 billion people lack sanitation facilities.¹⁹ Children are especially vulnerable to the resulting exposure to biological contaminants.

HEALTH OUTCOMES: Diarrheal disease can result in poor nutrition, anemia, retarded growth, and death due to acute dehydration or more chronic medical consequences. Diarrhea accounts for 17 percent of childhood mortality,²⁰ and despite improvements in the past decade, diarrhea is still responsible for nearly 2 million child deaths every year.²¹

ACTIONS:

Countering the ravages of childhood diarrhea calls for immediate action.

Interventions to prevent diarrhea—such as increased access to drinking water and sanitation, handwashing, use of hygienic latrines, safe water storage at home, and water treatment at home—are well known and have been shown to be effective.



Developing Indicators as a Policy Tool—Using Diarrhea as an Example

Children's environmental health indicators can help guide efficient data collection, track progress, and give early warning on possible outbreaks of epidemics.

Changes in child morbidity and mortality from diarrhea demonstrate the effectiveness or failure of preventive or remedial actions.

ENVIRONMENT & EXPOSURE

- What are the concentrations of biological contaminants in drinking water?
- What percentage of the population lacks access to safe drinking water and/or sanitation facilities?
- What percentage of the population has access to methods for safe storage of water in the home?
- What percentage of the population has access to sufficient water to permit adequate hygiene, access to soap or other hand cleansing methods?



HEALTH OUTCOMES

- What are the diarrhea morbidity and mortality rates for children?
- Are outbreaks of key diseases, such as cholera, occurring?



preventive:

- Source water protection (improved water supply and sanitation)
- Water disinfection and safe storage
- Promotion of improved hygiene practices
- Access to soap/hand cleaning methods
- Public education to encourage breast feeding

ACTIONS

remedial:

- Use of oral rehydration therapy (ORT)
- Access to health facilities or health providers

A Case Study of Childhood Lead Poisoning

TAKING COORDINATED GLOBAL ACTION

Lead exposure is better understood than many other children's environmental health problems, and all available information tells us that prevention of exposure is the only effective solution to lead poisoning. However, understanding the extent of the lead exposure problem, controlling all sources of lead, monitoring interventions and educating populations and policy-makers about the dangers of lead exposure remain a challenge.

LEAD INDICATORS: The concentrations of lead in children's bloodstreams are known to correlate with the amount of lead in the environment.

ENVIRONMENT AND EXPOSURE: Lead is a naturally occurring substance but its prevalence in the environment is

due to human activities. One of the major sources of lead in air is combustion of leaded gasoline. Other sources include water from lead pipes; lead paint; batteries, cosmetics, and ceramic ware; food grown near polluted areas; drinks and food from cans that contain lead; certain folk health remedies; and lead-contaminated soil and dust.

HEALTH OUTCOMES: Health effects from lead exposure vary with the age of the person exposed and the amount of exposure. Childhood lead poisoning can cause devastating health effects. Even small amounts of lead can interfere with development of the brain of a child; effects can be long-term and irreversible. Depending on the amount of exposure, resulting health outcomes may include

learning disabilities, lowered IQ, impaired motor skills, damage to organs, impaired growth, and death in extreme cases.

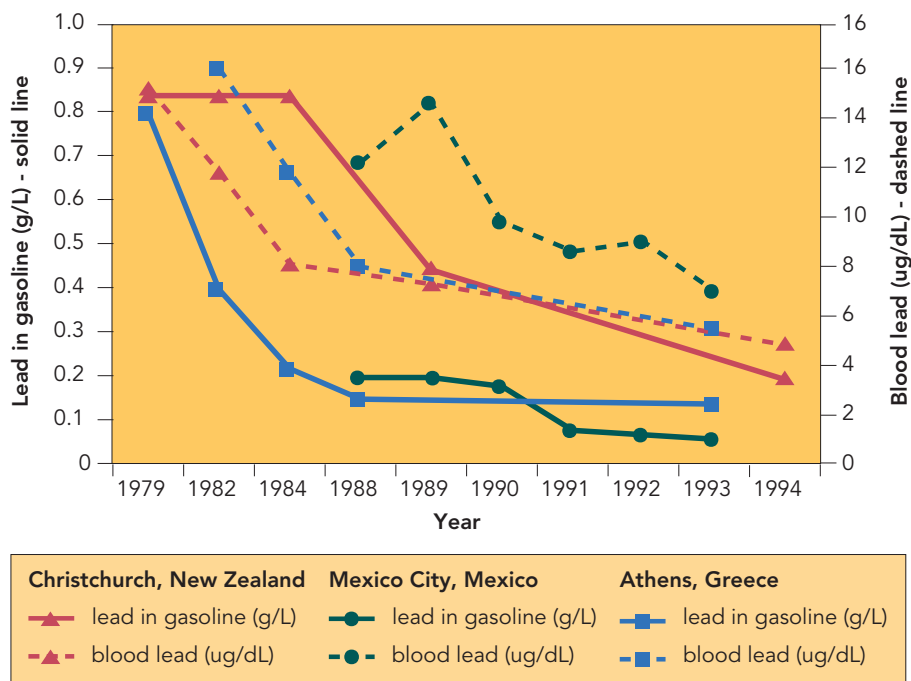
THE ROLE OF INDICATORS:

Indicators play a useful role in enabling policy makers to monitor reductions, assess interventions, identify and reduce sources of lead exposure, and evaluate compliance with regulations. Technology is available to measure blood lead concentrations and identify environmental lead hazards. There are data showing that some countries have made major strides in lowering these concentrations.²² (See graph below.)

However, the extent of the global lead exposure problem is still largely unknown because data on childhood lead poisoning are scarce. For many countries, population exposure and environmental contamination data are not collected, data may be incomplete or not comparable to data of other countries, and resources for data collection are not available.

NEXT STEPS: The lead example highlights the need to coordinate indicator development, data collection, and intervention monitoring to understand the extent of the problem and take actions to solve it. While some countries have phased out leaded gasoline and banned lead paint products, in many countries much remains to be done to protect children's health. Continued success in reducing childhood lead poisoning requires worldwide elimination of leaded gasoline and removal of lead from other sources in order to prevent exposure.

Correlation between blood lead levels and gasoline lead levels



Comparison of lead concentrations in gasoline and blood. Some data sets are for children; others are for adults. As Christchurch illustrates, changes in other sources of lead can also affect blood lead levels. Data taken from Thomas VM, Socolow RH, Fanelli JJ, and Spiro TG, Effects of Reducing Lead in Gasoline: Analysis of the International Experience, Environmental Science and Technology, Vol. 33, No. 22, 3942-3947, 1999.

Challenges to International Indicator Development

POLICY-MAKERS FACE A number of challenges as they endeavor to improve children's environmental health and craft a coordinated strategy for using indicators.

- ▶ More information is needed on the linkages between environmental conditions and health outcomes;
- ▶ The amount and quality of data available in each country vary, as does the ability of different countries to collect and synthesize additional data;
- ▶ The ability of countries to establish and support

projects to develop indicators and improve children's environmental health, and

the resources necessary to do so, vary.

“Actions to protect children from environmental hazards will be, at the best, arbitrary and unsystematic until a core set of good indicators can be widely adopted. Since indicators receive media attention, they can also play a crucial role in bringing the public's focus to the issue. Most importantly, such indicators will provide a sound basis for children's environmental health policies.”

— *Children in the New Millennium: Environmental Impact on Health (2002)*, UNEP, UNICEF, and WHO.



International Support for Children's Environmental Health

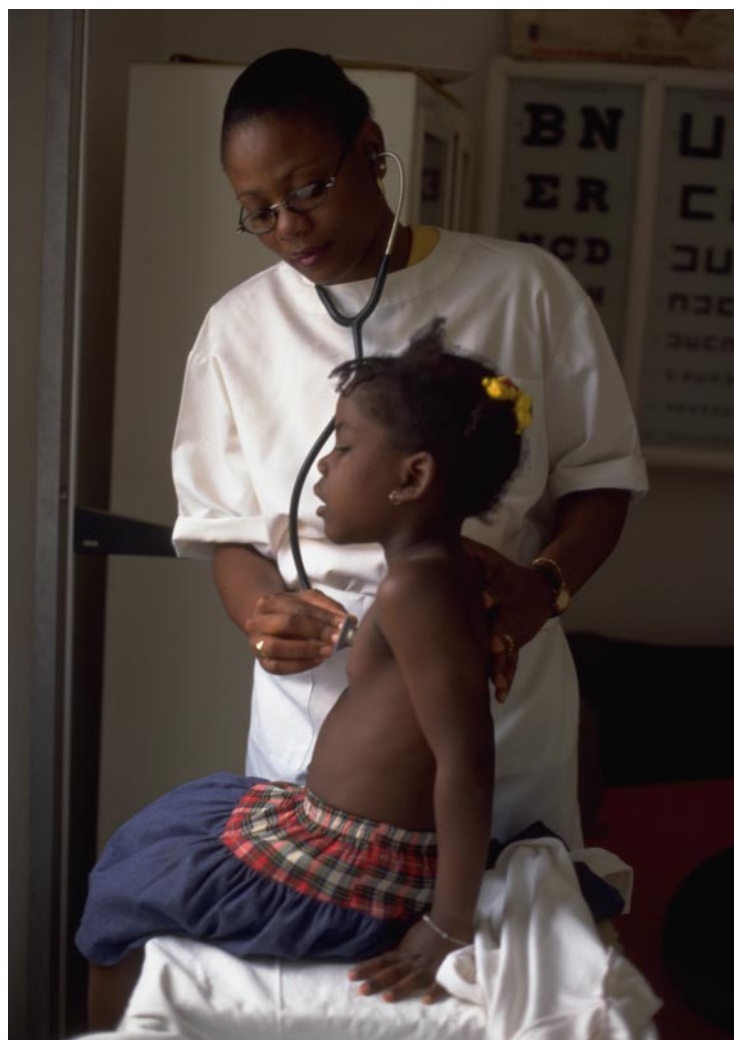
1. Final Communiqué of the 9th Regular Session of the CEC, June 2002. Members of the Council from Canada, Mexico and the United States *"agreed to a cooperative agenda to protect children from environmental risks"* including *"selecting and publishing a core set of children's environmental health indicators for North America."*
2. *A World Fit for Children*, United Nations General Assembly Special Session on Children, New York, May 2002: Governments pledged to: *"Develop legislation, policies and programmes, as appropriate, at the national level and enhance international cooperation to prevent, inter alia, the exposure of children to harmful environmental contaminants in the air, water, soil and food."*
3. G8 Environment Ministers, Banff Ministerial Statement on the World Summit on Sustainable Development, April 2002: *"Recognizing that the task of protecting children's health from environmental threats is ongoing, we agree to collectively advance work on the development of children's environmental health indicators as a means for monitoring progress, in consultation with relevant multilateral organizations."* This statement builds on earlier statements made by G-8 leaders. The first on children's environmental health was made in June 1997 at the Denver Summit of Eight (G8). *"Protecting the health of our children is a shared fundamental value. Children throughout the world face significant threats to their health from an array of environmental hazards, and we recognize particular vulnerabilities of children to environmental threats."*
4. Health and Environment Ministers of the Americas (HEMA), Ministerial Communiqué, March 2002: *"As a first step, we would work together to develop a set of indicators for children's health and the environment and water quality."*
5. European Environment and Health Ministers in the Declaration of the Third Ministerial Conference on Environment and Health, June 1999: Ministers called for *"an effective mechanism for monitoring and reporting progress annually throughout the Region on the basis of key indicators of the state of children's health and the relevant environmental conditions."*

The Time to Act Is Now

WE CALL ON GOVERNMENTS, non-governmental organizations, inter-governmental organizations, the private sector, communities, and UN agencies to work together to develop, implement, monitor, and report indicators in order to improve and safeguard children's environmental health. This indicators project is intended to link and consolidate existing efforts, promoting international participation.

Next steps are to:

- ▶ Develop child-specific indicators to monitor the effects of environmental risk factors on children's health with relevance to decision-making;
- ▶ Conduct pilot studies to validate the applicability of selected indicators;
- ▶ Integrate children's environmental health indicators with existing surveys and encourage survey design or community self-assessment where surveys are not in place;
- ▶ Identify and work with key agencies or institutes that will be implementing the process at the country level;
- ▶ Coordinate efforts to monitor and report on indicators so that data collected, indicators used, and interventions undertaken are comparable at a county-to-country level.



There is much to be gained from sharing best practices and sharing data, as well as by better collaboration among the national and international actors involved with children's environmental health. Together, all interested parties can join forces to make systematic use of children's environmental health indicators and protect children. By focusing on the world's children, we invest in our future and the future of generations to come.

To discuss country or organizational involvement with

this effort, please contact one of the following:

Environment & Health Program
PHYSICIANS FOR SOCIAL
RESPONSIBILITY

Water and Sanitation Section
UNICEF

*Office of Children's Health
Protection*
US ENVIRONMENTAL
PROTECTION AGENCY

*Protection of the Human
Environment*
WORLD HEALTH
ORGANIZATION

For Further Reading

- ▶ American Academy of Pediatrics, Committee on Environmental Health. *Handbook of Pediatric Environmental Health*. Elk Grove Village, Illinois, American Academy of Pediatrics, 1999.
- ▶ Briggs DJ, "The Environmental Burden of Disease on Children: Indicators and Information Needs," unpublished paper, Feb. 28, 2002.
- ▶ Corvalan C, Briggs D, Kjellstrom T, "The Need for Information: Environmental Health Indicators," in: Corvalan C, Briggs D, Zielhuis G (Eds). *Decision-making in Environmental Health— From evidence to action*. E&FN SPON on behalf of WHO. London, 2000.
- ▶ Smith KR, Corvalan CF, Kjellström T, How much global ill health is attributable to environmental factors? *Epidemiology* 10 (5), 573–584, 1999.
- ▶ Tamburlini G, von Ehrenstein O and Bertollini R (editors). *Children's Health and the Environment: A Review of Evidence*. A joint report from the European Environment Agency and the WHO Regional Office for Europe, Environmental issue report No 29, Luxembourg: Office for Official Publications of the European Communities, 2002.
- ▶ United States Environmental Protection Agency, America's Children and the Environment: A First View of Available Measures, Dec. 2000. EPA 240-R-00-006, Appendix A, Table B1.
- ▶ United Nations Children's Fund (UNICEF), *Progress since the World Summit for Children: A Statistical Review*, prepared for the United Nations Special Session on Children, September 2001.
- ▶ United Nations Environment Programme (UNEP), United Nations Children's Fund (UNICEF), and World Health Organization (WHO), *Children in the New Millennium: Environmental Impact on Health* (2002), Online at: www.unep.org, www.unicef.org, and www.who.int.
- ▶ World Health Organization, *Environmental Health Indicators: Framework and Methodologies*. World Health Organization, Geneva, 1999.

Notes

¹ World Health Organization, "Environmental hazards kill at least 3 million children aged under 5 every year." Press release, March 3, 2002. Online at: <http://www.who.int/inf/en/pr-2002-12.html>.

² United Nations Environment Programme (UNEP), United Nations Children's Fund (UNICEF), and World Health Organization (WHO), *Children in the New Millennium: Environmental Impact on Health* (2002), p. 72. [hereinafter *Children in the New Millennium*]

³ *Children in the New Millennium*, p. 70.

⁴ *Children in the New Millennium*, p. 47.

⁵ World Health Organization, *Health and Environment in Sustainable Development—Five Years After the Earth Summit* (Geneva 1997); Smith KR, Corvalan CF, Kjellström T, How much global ill health is attributable to environmental factors? *Epidemiology* 10 (5), 573–584, 1999.

⁶ *Children in the New Millennium*, p. 47.

⁷ *Children in the New Millennium*, p. 22; Smith et al, supra n 5.

⁸ Adapted from: Briggs DJ, World Health Organization, *Environmental Health Indicators: Frameworks and Methodologies*, Geneva, 1999.

⁹ American Academy of Pediatrics, Committee on Environmental Health, *Handbook of Pediatric Environmental Health* (1999); National Academy of Sciences, *Pesticides in the Diet of Infants and Children* (1993).

¹⁰ Tamburlini G, von Ehrenstein O, Bertollini R (eds). *Children's Health and the Environment: A Review of Evidence*. A joint report from the European Environment Agency and the WHO Regional Office for Europe, Environmental issue report No 29, Luxembourg: Office for Official Publications of the European Communities, 2002, p. 207.

¹¹ Adapted from *Children in the New Millennium*, p. 82.

¹² United Nations Children's Fund (UNICEF), *Progress since the World Summit for Children: A Statistical Review*, prepared for the United Nations Special Session on Children, September 2001, p. 26. [hereinafter

Progress since the World Summit for Children]

¹³ Adapted from: Briggs DJ, "The Environmental Burden of Disease on Children: Indicators and Information Needs," unpublished paper, Feb. 28, 2002.

¹⁴ *Children in the New Millennium*, p. 69.

¹⁵ *Children in the New Millennium*, p. 72.

¹⁶ *Children in the New Millennium*, p. 70.

¹⁷ *Children in the New Millennium*, p. 69.

¹⁸ *Progress since the World Summit for Children*, p. 6.

¹⁹ *Progress since the World Summit for Children*, p. 8.

²⁰ *Children in the New Millennium*, p. 48.

²¹ *Children in the New Millennium*, p. 47.

²² Thomas VM, Socolow RH, Fanelli JJ, and Spiro TG, Effects of Reducing Lead in Gasoline: Analysis of the International Experience, *Environmental Science and Technology*, Vol. 33, No. 22, 3942–3947, 1999.

Acknowledgements

This brochure is the result of a collaborative effort between INCHEC, ISDE, PSR, UNEP, UNICEF, USEPA and WHO.

Special recognition is due to the lead authors: Karen Hopfl-Harris and Susan West Marmagas, Environment and Health Program, Physicians for Social Responsibility, USA; Martha Berger, Office of Children's Health Protection, EPA, USA*; Steve Gaffield, AAAS Environmental Science and Engineering Fellow, EPA, USA*; and Gilah Langner, Stretton Associates Inc., USA.

Special thanks are due to the following individuals who offered their guidance and advice on the creation of this document and/or offered extensive review and comment on various drafts of the document:

Crista Benson, Children's Environmental Health Network, USA; Liz Blackburn, EPA, USA*; John Borrazzo, U.S. Agency for International Development, USA; Joy E. Carlson, J. Carlson Consulting, USA; Rashid A. Chotani, The Johns Hopkins University, USA; Lilian Corra, Asociación Argentina de Médicos por el Medio Ambiente, Argentina; Carlos Corvalan, WHO, Switzerland; Liz Creel, Population Reference Bureau, USA; Dafina Dalbokova, WHO, Germany; Terri Damstra, WHO, USA; Madhumita Dutta, Toxics Link, India; Wendy Enright, Environment Canada, Canada; Ruth Etzel, George Washington University School of Public Health and Health Services, USA; Cathey Falvo, New York Medical College, USA; Global Health Council, USA; Stuart Gross, Center for Interna-

tional Environmental Law, USA; Tee Guidotti, George Washington University Medical Center, USA; Lara Hensley, Physicians for Social Responsibility, USA; Manoranjan Hota, Ministry of Environment and Forests, India**; Don Houston, Canadian Institute of Child Health, Canada; Maaikje Jansen, United Nations Environment Programme, USA; Tord Kjellstrom, Australian National University, Canberra, Australia; Eckhard Kleinau, Environmental Health Project, USA; Michal Krzyzanowski, WHO, Germany; Pranay Lal, Centre for Science and Environment, India; Philip Landrigan, Mount Sinai School of Medicine, USA; Molly Madden, EPA, USA*; Daniel B. Magraw Jr., Center for International Environmental Law, USA; Irma R. Makalinao, University of the Philippines College of Medicine, Philippines; Jayne Mardock, National Religious Partnership for the Environment, USA; Evelyn A. Mauss, Natural Resources Defense Council, USA; Melinda Moore, Department of Health and Human Services, USA; Jacob Moss, EPA, USA*; Hisashi Ogawa, WHO, Philippines; Rajan.R. Patil, Bangalore Community Health Cell, India; Jerome A. Paulson, George Washington University & Children's Environmental Health Network, USA; Erica Phipps, North American Commission for Environmental Cooperation, Canada; Jenny Pronczuk, WHO, Switzerland; Jingjing Qian, UNICEF, USA; Rob Quick, Centers for Disease Control and Prevention, USA; Maria Rapuano, Alliance to End Childhood Lead Poisoning, USA; Eva Rehfuess, WHO, Switzerland; K. W. James

Rochow, Alliance to End Childhood Lead Poisoning, USA; Hawa Senkoro, WHO, Congo, Brazzaville; Martha Shimkin, MShimkin Consulting, USA; Bimala Shrestha, Tr-Bhuban University, Nepal; Gaudenz Silberschmidt, International Society for Doctors for the Environment, Switzerland; Tom Sinks, Centers for Disease Control and Prevention, USA; Kirk R. Smith, University of California, USA; Kathy Sykes, EPA, USA*; Giorgio Tamburlini, WHO, Italy; Vanessa Tobin, UNICEF, USA; Sherri Umansky, EPA, USA*; Peter van den Hazel, International Network Children's Health, Environment and Safety, the Netherlands; Ondine von Ehrenstein, WHO, Italy.

Photo credits

Front cover (clockwise from upper left): PhotoDisc (USA); UNICEF/HQ92-0484/ Jeremy Horner (Ecuador); UNICEF/HQ96-1166/ Giacomo Pirozzi (Zambia)

Inside front cover: UNICEF/HQ92-0476/ Jeremy Horner (Ecuador)

page 1: UNICEF/HQ92-0128/ David Johnson (Burkina Faso)

page 3: UNICEF/HQ94-0856/ Nicole Toutounji (Haiti)

page 4: UNICEF/HQ92-0652/ Roger Lemoyne (Cambodia)

page 5: UNICEF/HQ97-0337/ Shehzad Noorani (Bangladesh)

page 6: UNICEF/HQ96-1026/ Shehzad Noorani (Philippines)

page 7: UNICEF/HQ96-1166/ Giacomo Pirozzi (Zambia)

page 9: UNICEF/HQ00-0967/ Roger Lemoyne (Afghanistan)

page 11: UNICEF/HQ98-1137/ Giacomo Pirozzi (Angola)

DESIGN BY

Cutting Edge Design, Washington, DC

Printed on process chlorine free 20% post-consumer recycled paper.

* Support for this project was made possible through Cooperative Agreement 83033001-0 between the Office of Children's Health Protection and the Office of International Affairs of the US Environmental Protection Agency (EPA) and Physicians for Social Responsibility. This document has been developed by EPA, PSR, UNICEF and WHO. This document has been reviewed by EPA personnel and does not establish an official EPA rule, regulation, guidance or policy. Further, EPA does not endorse any products or commercial services mentioned in this publication.

** These comments are personal comments of Dr. Manoranjan Hota and not that of the Government of India

**International Research and Information Network
for Children's Health
Environment and Safety (INCHES)**

Post Box 163
6950 AD Dieren
The Netherlands
phone: +31 26 3773915
fax: +31 26 3773847
e-mail: P.J.van.den.Hazel@inter.NL.net
web-site: www.inchesnetwork.org



International Society of Doctors for the Environment (ISDE)

Le Chateau
CH-1374 Corcelles-sur-Chavornay
Switzerland
phone: +41-24-441 56 50
fax: +41-24-441 56 51
e-mail: info@isde.org
web-site: www.isde.org



**Physicians for Social Responsibility (PSR)
Environment & Health Program**

1875 Connecticut Avenue, NW
Suite 1012
Washington, DC 20009
Phone: 202-667-4260
fax: 202-667-4201
e-mail: psrnatl@psr.org
web-site: www.psr.org



**United Nations Children's Fund (UNICEF)
Water and Sanitation Section**

3 United Nations Plaza
New York, NY 10017
phone: 212-326-7000
fax: 212-824-6480
web-site: www.unicef.org



**United Nations Environment Programme (UNEP)
New York Office**

2 United Nations Plaza DC2-803
New York, New York 10017
phone: 212-963 8210
fax: 212-963 7341
e-mail: info@nyo.unep.org
web-site: www.nyo.unep.org



**World Health Organization
Protection of the Human Environment**

20, Avenue Appia
CH-1211 Geneva 27
Switzerland
phone: +41 22 791 4475
fax: +41 22 791 4127
e-mail: osseirann@who.int
web-site: http://www.who.int/peh/ceh/

