

CHILDHOOD LEAD POISONING

Information for Advocacy and Action



UNEP
For Life on Earth



United Nations Children's Fund

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United Nations Children's Fund (UNICEF)

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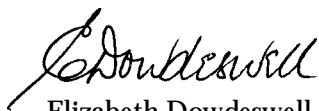
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FOREWORD

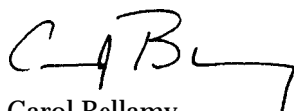
Lead poses an environmental and child health hazard of global proportions. It is a problem that demands urgent action. This booklet explains how children are affected by lead poisoning, and shows various ways to combat this scourge.

Our goal is to reduce the adverse health and environmental impacts of lead, particularly on children. This material, although not exhaustive, is based on the most recent scientific knowledge. It is intended to be a tool for advocacy and action in the hands of policy-makers, communities and everybody caring for children.

Childhood Lead Poisoning is the first in a UNEP-UNICEF information series dealing with environmental pollutants and their impacts on children. It is part of a wider effort to raise awareness of the linkages between environmental factors and the well-being of children. Working together, UNEP and UNICEF are helping to mobilize an active response to these global hazards.



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I. INTRODUCTION

“Lead makes the mind give way.”

—Greek Physician, 2000 B.C.



The protection of children and the environment from the negative effects of human activities is called for in several international agreements and legally binding documents, such as the United Nations Convention on the Rights of the Child and Agenda 21 adopted by the United Nations

Conference on Environment and Development. Due to human activities, lead, a heavy metal, pollutes the environment and poisons children.

Lead poisoning is a serious health hazard with major socio-economic implications. Lead is a potent neurotoxin (nerve poison), particularly in children whose growing bodies are highly susceptible. Exposure to excessive levels of lead in air, water, soil and food is harmful to the health and intellectual development of millions of children and adults, in almost all regions of the world.

Lead poisoning must be tackled through comprehensive strategies. These should be locally specific and supported at national, regional and international levels. Responses should include research activities based on which economic and legal instruments should be developed. In addition the public should be informed, health conditions monitored and, where necessary, treatment programmes established.

The purpose of this document is to provide you with information for advocacy and action, as regards lead poisoning and its effects on children and women.

SELECTED EXTRACTS FROM THE 1989 CONVENTION ON THE RIGHTS OF THE CHILD DEALING WITH THE ENVIRONMENT:
Preamble

The States Parties to the present Convention,
... Convinced that *the family, as the fundamental group of society and the natural environment for the growth and well-being of all its members and particularly children*, should be afforded the necessary protection and assistance so that it can fully assume its responsibilities within the community...

Have agreed as follows:

Article 24

1. States Parties recognize *the right of the child to the enjoyment of the highest attainable standard of health* and to facilities for the treatment of illness and rehabilitation of health. States Parties shall strive to ensure that no child is deprived of his or her right of access to such health care services.

2. States Parties shall pursue full implementation of this right and, in particular, shall take appropriate measures:

(c) To combat disease and malnutrition, including within the framework of primary health care, through, *inter alia*, the application of readily available technology and through the provision of adequate nutritious foods and clean drinking water, *taking into consideration the dangers and risks of environmental pollution; ...*

(e) To ensure that all segments of society, in particular parents and children, are informed, have access to education and are supported in the use of basic knowledge of child health and nutrition, the advantages of breast-feeding, hygiene and *environmental sanitation* and the prevention of accidents;

Article 29

1. States Parties agree that the education of the child shall be directed to:

(e) *The development of respect for the natural environment.*

SELECTED EXTRACTS FROM THE 1992 AGENDA 21, ADOPTED BY THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT, DEALING WITH CHILDREN ARE:

Chapter 6: Protecting and Promoting Human Health

- 6.1 ... Action items under Agenda 21 must address the primary health needs of the world's population, since they are integral to the achievement of the goals of sustainable development and primary environmental care...
- 6.19 ...The *health of children* is affected more severely than other population groups by malnutrition and adverse environmental factors...
- 6.24 Specific major goals for *child survival*, development and protection were agreed upon at the World Summit for Children and remain valid also for Agenda 21. Supporting and sectoral goals cover women's health and education, nutrition, child health, water and sanitation, basic education and children in difficult circumstances.
- 6.27 National Governments, in cooperation with local and non-governmental organizations, should initiate or enhance programmes in the following areas:
 A) Infants and children:
 (i) Strengthen basic health-care services for children in the context of primary health-care delivery, including prenatal care, breast-feeding, immunization and nutrition programmes;...
 (iv) *Protect children* from the effects of environmental and occupational toxic compounds...

Chapter 25: Children and Youth in Sustainable Development

- 25.12 *Children* not only will inherit the responsibility of looking after the Earth, but in many developing countries they comprise nearly half the population. Furthermore, children in both developing and industrialized countries are highly vulnerable to the effects of environmental degradation...
- 25.13 National governments, according to their policies should take measures to:
 (a) Ensure the *survival, protection and development of children*, in accordance with the goals endorsed by the 1990 World Summit for Children.

II. WHAT IS KNOWN ABOUT LEAD AND LEAD POISONING?

At low levels, lead poisoning in children causes:

- reduction in IQ and attention span
- reading and learning disabilities
- hyperactivity and behavioural problems
- impaired growth and visual and motor functioning
- hearing loss

At high levels, lead poisoning in children causes:

- anaemia
- brain, liver, kidney, nerve, stomach damage
- coma
- convulsions
- death

These effects of lead poisoning on children are:

- long-term and potentially irreversible
- intensified with repeated exposure and accumulation of lead in the body

LEAD

- Lead (Pb) is a heavy metal.
- Lead occurs naturally in the earth's crust and is dispersed in small amounts into the environment by natural processes.
- Lead is also brought into the environment through human activities, in 300 times greater amounts than through the natural processes.¹
- Lead accumulates in the environment, is non-biodegradable and does not lose its toxicity over time.
- Lead is toxic when ingested and inhaled.
- Lead circulates in the bloodstream, is reabsorbed in the kidneys and the brain, and is deposited in bones and teeth.
- Lead's toxicity at high levels of exposure has been known for millennia.
- Lead's toxicity at low levels of exposure has been uncovered only recently by intensive research.

LEAD EXPOSURE

- Humans are exposed to lead through air, dust, water and food.
- Millions of children and adults are exposed to excessive levels of lead in the environment, at home, school and the workplace.
- Residents in urban areas have higher lead levels in their blood than those in rural areas.²
- Developing country populations, particularly children, may be under high level lead exposure due to:
 - unregulated industrial emissions and car emissions through leaded gasoline.³
 - lax enforcement of environmental and occupational health safety regulations.
 - 'cottage' (domestic) industries (e.g. metal polishing and smelters).

— certain cultural practices (e.g. use of folk medicines containing lead, use of improperly glazed lead ceramic ware for cooking and food storage, use of lead-contaminated cosmetics such as surma and kohl).

LEAD POISONING

- Lead is an environmental and public health hazard of global proportions. Yet, the global dimensions of lead poisoning remain poorly understood, due to the persisting lack of information. The vast majority of studies have been carried out in developed countries.
- Causes of lead poisoning are local, vary from community to community and country to country.
- Growing evidence suggests that lead in a child's body, even in small amounts, can cause disturbances in early physical and mental growth, and later in intellectual functioning and academic achievements.⁴ Thus lead poisoning is not only an environmental health problem, but also a social issue.⁵
- Urban children in developing countries are most at risk. It was estimated in 1994 that over 80% of those between three and five years of age and 100% under two had average blood lead levels exceeding the threshold of 10 µg/dl set by the US Centers for Disease Control and Prevention.⁶ Children abuse substances which may contain lead, for example children who live and work on the streets sometimes sniff leaded gasoline.
- Even in the world's most developed countries it is estimated that a large proportion of children suffer from lead poisoning. Even though only 28% of children between three and five years of age have average blood lead levels over 10 µg/dl, 78% of children under two exceed this threshold.⁶ It is the most common, chemical related, environmental child health problem. This is especially pronounced in economically disadvantaged sections of the population. Poverty can cause malnourishment or physical stress, which intensifies disabilities caused by lead absorption.⁷
- If a pregnant woman is exposed to lead, it can be carried to the unborn child and cause premature birth, low birth weight or even abortion.

CHILD VULNERABILITY TO LEAD

- Child nervous and digestive systems are developing. They are thus more susceptible to lead uptake. Children absorb up to 50% of lead taken into their bodies, compared to 10–15% in adults. Children may receive 3 times the dose of adults, because they have a larger surface to volume ratio.
- Children have a propensity to explore the world through their mouths. Lead in the air attaches to dust, which is widespread in household environments where young children are crawling, playing and touching. Lead in dust and dirt can be ingested via children's hands and toys, for example by thumb sucking or by putting objects in their mouths. Young children might ingest as much as 200 mg per day, particularly if they live in cities or near busy streets.
- In addition, the foetus is exposed through the mother's blood, which can contain lead ingested from her childhood onwards. The body can store lead for more than 20 years and then release it during pregnancy, harming the foetus⁸ (lead can move across the placenta with ease).

TOLERANCE LEVELS FOR LEAD

- The more research results become available, the lower the levels become at which preventive and remedial action should be taken. Thus marker levels for tolerance for lead are unclear.
- Current toxicity studies suggest that:
 - a blood-lead concentration of $10\ \mu\text{g}/\text{dl}$ (micrograms per decilitre, indicating the amount of lead in a tenth of a litre of blood, a common way of indicating the lead stored in an individual's body) is considered as an *action level*.⁹ (This can be reached when a child ingests approximately 225 ml of contaminated water per day.)
 - an amount of $45\ \mu\text{g}/\text{dl}$ demands that *treatment* begin within 48 hours;
 - more than $70\ \mu\text{g}/\text{dl}$ in blood presents a medical *emergency*;
 - over $120\ \mu\text{g}/\text{dl}$ in blood is highly toxic and potentially *lethal*.
- Studies have shown that even at $10\ \mu\text{g}/\text{dl}$ blood-lead level, detrimental effects on child development and behaviour can be observed.

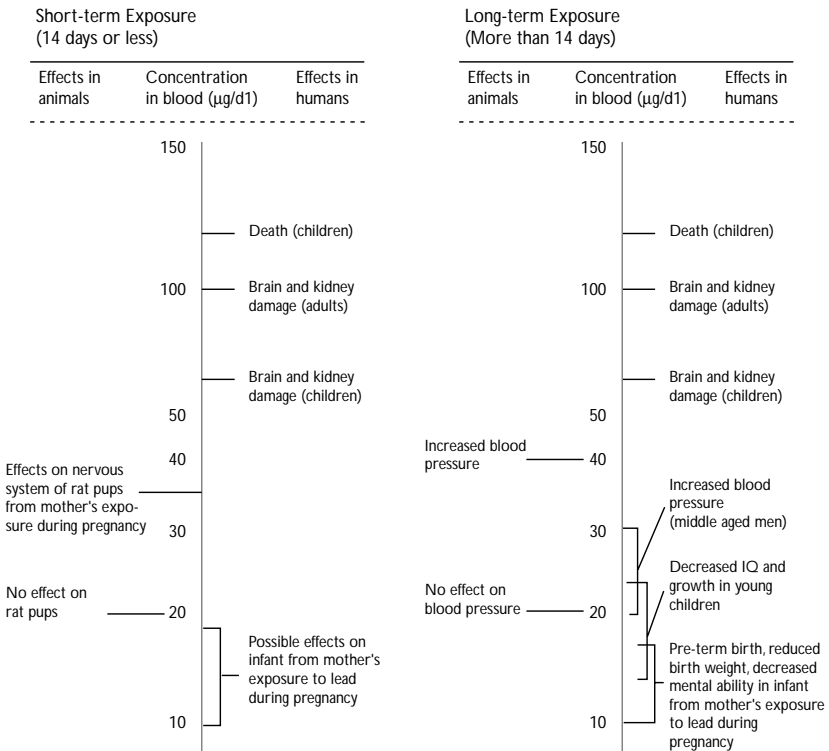
Further studies suggest that at any level the detrimental effects of lead on child or adult health can be detected.

SOURCES OF SIGNIFICANT LEAD EXPOSURES FOR CHILDREN

- **Lead in air** occurs primarily due to gasoline additives.¹⁰ The combustion of leaded gasoline causes a fallout of lead oxides in dust, which can be inhaled. It can also contaminate soil used to grow crops and feed livestock. Furthermore, soil found in playgrounds and gardens can be polluted. Cars that rely on leaded gasoline account for up to 95% of airborne lead pollution in developing countries.

FIGURE 1.

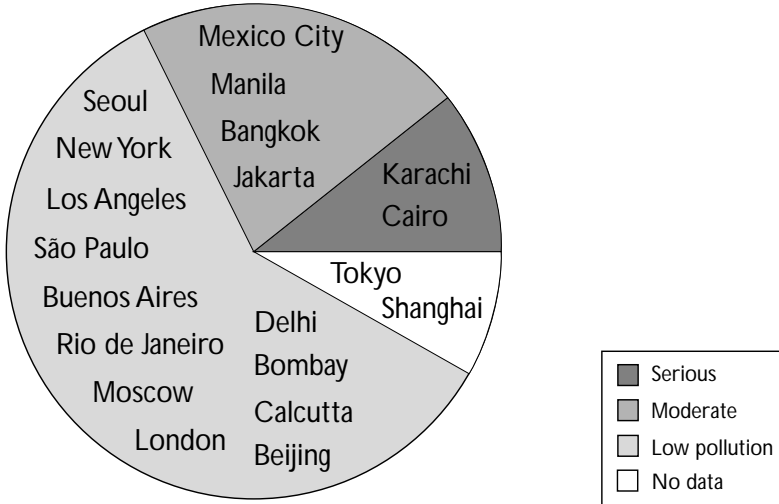
Health Effects from Ingesting and Breathing Lead



Source: US Agency for Toxic Substances and Disease Registry (1600 Clifton Rd., E-29, Atlanta, Georgia 30000, USA), April 1993

- *Lead in dust* derives from soil and airborne pollutants or from parents who bring it into the home after having been exposed at the workplace. Dust settles on ‘friction’ surfaces like doors or windows which are used daily. In addition to inhaled dust, children ingest it through regular hand-to-mouth behaviour.
- *Lead in water* occurs through contamination at various points in the drinking water delivery system, e.g. lead pipes and solder, water faucets, etc. Lead can also leach into groundwater from soil polluted with fallout from leaded gasoline, crop irrigation and food processing in factories and homes.¹¹ 15 µg/l in drinking water is currently considered as an acceptable level.¹²
- *Lead in food* results from food and drink cans, manufactured in many countries, which continue to contain lead solder that can leach into the food and drink. Concentrates of lead can be found in vegetables, particularly green leafy ones.

FIGURE 2
Levels of lead in air in 20 mega-cities



Note: “Serious” describes the situations where WHO guidelines are exceeded by more than a factor of two; “Moderate” indicates that WHO guidelines are exceeded by up to a factor of two, with short-term guidelines being exceeded on a regular basis at certain locations; “Low” suggests that WHO guidelines are normally met but short-term guidelines may be exceeded occasionally.

Source: Adapted from *Air Pollution in Mega-Cities of the World*, UNEP/WHO (1992).

- *Lead in paints* is the major source of lead in homes. Children are at risk from peeling paint chips, which they tend to take in their mouths. Home gardens can be contaminated by paint peels or rain-washed run-offs from lead-based paints.
- *Lead in ceramic glazes* can leach out of ceramic ware, china and crystal, especially if the food is acidic.¹³
- *Lead in cosmetics and folk remedies* is found in substantial quantities, especially in the developing world.¹⁴
- *Other sources of lead include:* lead smelters, incinerators, battery recycling plants and other industrial activities, disposal of products containing lead (e.g. pencils). Some activities such as battery recycling, can take the form of heavily polluting 'home backyard' industries that are difficult to identify.

III. WHAT CAN BE DONE TO PREVENT LEAD POISONING?

Strategies to prevent lead poisoning must be locally specific and should be supported at national and international levels. Strategies should be sensitive to differing cultural, political, economical, technological and developmental circumstances.

AT THE LOCAL LEVEL:

- Everybody who cares for children should be aware of the problems caused by lead, and therefore should be encouraged to:
 - test child blood for lead levels at 12 or 24 months of age (or even at 6 months, depending on the presence of sources of lead in the child's environment), and, if possible, routinely until age 6. In developing countries, where local access to blood tests is often difficult, testing facilities should be developed.
 - detect possible symptoms, as a child may not feel ill. Symptoms, which are commonly associated with other childhood ailments and thus can be difficult to distinguish, include: stomach- or headaches, poor appetite, disturbed sleeping pattern or irritableness.
 - feed the child a nutritious diet (regular meals, foods rich in calcium and iron).
 - ensure hygienic conditions, especially hand-washing and thorough cleaning of vegetables and fruits.
 - reduce and eliminate possible sources of lead (in paint, soil, water and food).
 - keep leaded products out of the reach of children.
 - practise good housekeeping, including wet cleaning to remove dust containing lead.
- Community-wide lead poisoning prevention and educational activities should be promoted, including the discouragement of the use of local cosmetics and folk remedies containing lead.

- Local authorities should be trained to identify and monitor for the presence of point sources of community lead pollution.
- The ability of medical facilities to monitor and treat lead poisoning should be strengthened.

AT THE NATIONAL LEVEL:

- Environmental, public health, economic and legal aspects of the issue should be examined in an integrated way to enable comprehensive and feasible strategies, to be implemented at the local level.
- Legislation should be encouraged and/or reinforced to regulate, reduce or abolish lead in products such as: gasoline, paint, water (and water piping and fixtures), ceramic glazes and solder on food cans, etc.
- Authorities should develop regional, national or international collaboration, in order to ensure high quality laboratory analysis of blood and environmental samples for lead. This capability is absolutely essential for the generation of reliable and accurate information on lead-related public health problems. Monitoring of populations and the environment should be backed.
- Technological changes should be supported. The long-term benefits and costs of reducing and substituting lead in products and industrial processes should be determined. For example, technical solutions for phasing out lead in gasoline are relatively easy and the costs are modest, making it a particularly cost-effective policy.
- Exposures to lead in the workplace should be strictly regulated and limited.
- Advances in clinical care should be supported and fostered.
- Policies should be developed through the participation of all stakeholders with a direct interest in reducing lead exposure, such as: government agencies, large and small industries, organized labour, public health care providers, and environmental and community groups.

Phasing out Lead in Gasoline

- By the end of 1996, 18 countries phased out lead from gasoline completely: Argentina, Austria, Bermuda, Brazil, Canada, Colombia, Costa Rica, Denmark, El Salvador, Finland, Guatemala, Honduras, Japan, Nicaragua, Slovakia, Sweden, Thailand and the United States.
- According to the World Bank, countries can save five to ten times the cost of converting to unleaded gasoline in health and economic savings. The USA saved more than 10 dollars for every one it invested in the conversion due to reduced health costs, savings on engine maintenance and improved fuel efficiency.
- Regional and international financial mechanisms exist to assist countries in making the transition to unleaded gasoline.

Source: World Bank 1996-1997

AT THE REGIONAL AND INTERNATIONAL LEVELS:

- International cooperation should be enhanced. Donors and international financial institutions should assist developing countries to reduce lead in products and industrial processes, including the formulation of appropriate policies and capacity building.
- The sharing of appropriate technologies, experience with best practices, and cost-effective strategies should be encouraged. Collaboration is especially useful among countries confronting similar situations. For example, 26 environment ministers from OECD nations adopted a Declaration of Risk Reduction for Lead, which addresses each of the major sources of lead exposure through voluntary cooperation by the industry (February 1996).¹⁵
- Relevant data should be collected, analysed and shared. Results should be evaluated and follow-up ensured. Lead exposure merits global attention; accordingly research should be undertaken on a wide range of populations in developing and developed countries, not restricted to those with evident high exposure levels.
- In addition to health-related studies, increased research on economic aspects of the issue should be undertaken.¹⁶ The economic benefits

of preventing health damage, although country specific, is believed to be substantial. This data can be used as a tool to encourage public policy and awareness.

- UNEP and UNICEF, along with their partners, need to engage in professional dialogues with a view to raising public awareness and catalysing actions at various levels.

The above information is intended to stimulate a further discussion on the subject of major environmental pollutants and their effects on children and women.

ENDNOTES

- 1 *Impact of Lead and Agrochemicals on Children*, a report to UNICEF by Environmental Protection Encouragement Agency, Hamburg, 1992. Total amount of lead released into the environment is estimated at approximately 860,000 to 1,670,000 metric tons per year.
- 2 Experts expect that children living in cities may suffer as much as a 4 point IQ loss compared to those who live in the suburbs. In Cairo, more than 800 infants die annually due to their mother's exposure to lead. (World Bank, June 1996.)
- 3 Many developed countries export leaded gasoline, and cars that use leaded gasoline, to developing countries.
- 4 A 1990 study in Bangkok, Thailand, suggested that 30,000 to 70,000 children risked a loss of 4 or more IQ points because of high lead levels, more risked lesser reductions in intelligence (*The Urban Environment: World Resources 1996-1997*).
- 5 Studies in the USA show that aggressiveness and delinquency in boys is associated to lead in bones. It is suggested that this could lead to more serious antisocial behaviour in later life (New York Times, 2 February 1996).
- 6 Alliance to End Childhood Lead Poisoning and the Environmental Defense Fund, *The Global Dimensions of Lead Poisoning*, Washington D.C. (1994).
- 7 A recent American national survey estimated that one in eleven children under age 5 had high lead concentrations in their blood. Among some minority sub-groups a much higher rate was found. For example, one in five non-Hispanic black children under age 5 had high blood-lead concentrations (pers. comm. Harvard Medical School, August 1996).
- 8 Maternal and umbilical-cord blood-lead levels of 10 µg/dl (micrograms per decilitre, indicating the amount of lead in a tenth of a litre of blood, a common way to indicate blood levels) are associated with low birth weight and prematurity.
- 9 US Centers for Disease Control and Prevention (1996).

- 10 In the USA, the banning of tetraethyl lead from gasoline resulted, on average, in a fall of the level of lead in blood by 75% (New York Times, 13 March 1996). Studies have also shown that lead poisoning is decreasing in Bangkok, Thailand, with increased use of unleaded petrol (Bangkok Post, 18 March 1996).
- 11 US/EPA estimates that 20% of Americans' lead exposure is through water (*The Arc's Questions and Answers on Lead Poisoning: Childhood Lead Poisoning Prevention*, Internet 1996).
- 12 US Environment Protection Agency (US/EPA) 1991.
- 13 Glazed ceramic ware has been known to contribute to population-wide exposure to lead in Mexico (E. Chivian et al., *Critical Condition*, 1994).
- 14 Toxic exposures have been reported among residents in China, India, the Middle-East and South America (E. Chivian, *Critical Condition*, 1994).
- 15 A recent initiative (December 1996) was an international consultative workshop, organized by UNEP and OECD, to discuss the reduction of lead in gasoline.
- 16 An early US study indicated that a 1 µg/dl decrease in mean blood-lead concentrations in the population would produce at least \$3.5 billion per year in benefits from reduced health effects of lead. Please refer to the Annex for a detailed breakdown (*Societal Benefits of Reducing Lead Exposure*, Environmental Research, J. Schwartz, 1994).

ANNEX

Annual Economic Benefits of Improving the Population's Health by Reducing Mean Blood Lead Levels by 1 µg/dl in the USA

Source of Benefits	Amount (millions US\$)
Children	
Medical Costs (e.g. low birth weight, low gestational age)	189
Neonatal Care (intensive care)	67
Infant Mortality	1,140
Compensatory Education (length of education/special education or assistance)	481
Earnings Loss (lifetime productivity and earning power)	5,060
Sub-total	6,937
Adults	
Medical Costs (physicians, drugs, hospitalisation)	
Hypertension	399
Heart Attacks	141
Strokes	39
Lost Wages (reduced working time)	
Hypertension	50
Heart Attacks	67
Strokes	19
Mortality (risk of premature death)	9,900
Sub-total	10,615
Total	17,552

Source: Adapted from Schwartz, 1994

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"...Given the severe and irreversible health effects of lead poisoning, particularly on children, it is important to accelerate the process of eliminating unsafe uses of lead, including the use of lead in gasoline worldwide, in light of country-specific conditions and with enhanced international support and assistance to developing countries, particularly through the timely provision of technical and financial assistance and the promotion of endogenous capacity-building. ..."

— from the Programme for the Further Implementation of Agenda 21 adopted by the 19th Special Session of the General Assembly, New York, 23-27 June 1997