

Childhood Pesticide Poisoning

Information
for Advocacy
and Action

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Prepared for the United Nations Environment Programme (UNEP)

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I. Introduction

Pesticide poisoning is a serious health problem that disproportionately affects infants and children. Pesticides are designed to kill, reduce or repel insects, weeds, rodents, fungi, and other organisms that can threaten public health and national economies. However, when improperly used or stored, these chemical agents can also harm humans. Key risks are cancer, birth defects, and damage to the nervous system and the functioning of the endocrine system.

People can be exposed to excessive pesticide levels while working; via food, soil, water or air; or by directly ingesting pesticide products. Pesticides are known to cause millions of acute poisoning cases per year, of which at least one million require hospitalization. The number of children involved in such incidents is unknown but, based on the experience of many countries, likely to be large. Between one and three agricultural workers per every 100 worldwide suffer from acute pesticide poisoning [1, 2], and adolescents are often the victims.[3, 4] The contribution of pesticides to chronic diseases, on the other hand, is unknown.

Tackling the risks to children of pesticide exposure and poisoning requires comprehensive strategies. These strategies should be designed for the local level and supported nationally, regionally and internationally. They should include research activities on how to develop effective economic and legal instruments. In addition, they should ensure that the public is informed, health conditions are monitored and, where necessary, treatment programs are established.

The need for such strategies is confirmed by a number of international agreements that call for actions to protect children and the environment from the negative effects of human activities. These include the United Nations Convention on the Rights of the Child as well as Agenda 21, which was adopted by the United Nations Conference on Environment and Development.

The purpose of this document is to provide you with information for advocacy and action directed at reducing pesticide poisoning and addressing 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 ...

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 know-

ledge of child health and nutrition, the advantages of breastfeeding, 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 Agenda 21, adopted
in 1992 by the United Nations Conference
on Environment and Development, that deal
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. They are also highly aware supporters of environmental thinking. The specific interests of children need to be taken fully into account in the participatory process on environment and development in order to safeguard the future sustainability of any actions taken to improve the environment.

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 do we know about pesticide poisoning and why are children at greater risk?

Summary

Children are often more vulnerable than adults to the effects of pesticides as a result of several risk factors. These include their smaller size; greater rates of exposure to food, soil, water, and air; differing metabolism; and rapidly growing and developing organ systems. They tend to explore their immediate environment more than adults do and to put things in their mouths. Inexperience, lack of maturity, illiteracy and an inability to assess risk make children more likely to accidentally ingest pesticides. Children who work around pesticides face additional opportunities to be severely poisoned. [3, 4] Because children are at greater risk, they need greater protection.[5] More awareness-raising is needed about risks, especially from the most acutely toxic pesticides, since adverse effects on children are completely preventable.

Hazardous by design

Pesticides are toxic substances designed to kill, repel or inhibit the growth of living organisms. They are used against insects, mammals, plants, fungi, nematodes and other creatures that can pose problems for agriculture, public health, or homes, schools, buildings and communities.[6]

Pesticides impair the functioning of biological processes essential for life, such as the nervous and reproductive systems. Very often, these processes are similar among different organisms, whether insects or humans, adults or children.

Many pesticides have similar chemical structures and thus may act in the same way. For example, the organophosphate and carbamate insecticides poison insects by inhibiting the enzyme acetyl cholinesterase. This mode of action can also be toxic to people. By regulating pesticides one at a time we may be underestimating the cumulative impact of pesticides of similar toxicity.[5]

Unintended – but harmful – effects

The unintended but harmful effects of pesticides have become clearer in recent decades, which has increased the urgency for taking action. For example, if used on a broad scale, pesticides can disrupt the ecological balance of agricultural areas by killing natural biological controls; this can lead to outbreaks of pests that were previously of minor importance and consequently to lower crop yields. Once used, pesticides may accumulate in the air or water or on land, where they can harm non-target species and diminish biodiversity. By contaminating groundwater, lakes, rivers, and other bodies of water, they can pollute drinking supplies, fish and other resources that can be vital for human well-being. By polluting soil, they can endanger children at play or at work and make it difficult to use the land later for other purposes.

Pesticides are harmful to human health. It has been reported that an estimated 1 million to 5 million cases of pesticide poisonings occur every year, resulting in 20,000 fatalities among agricultural workers. Most of these poisonings take place in developing

countries, where safeguards typically are inadequate or lacking altogether.[6][1] Although developing countries use 25% of the world's production of pesticides, they experience 99% of the deaths.[1]

The total health impact of pesticide exposure is probably much greater than these figures suggest. The symptoms of pesticide poisoning, which may involve a skin rash or mild gastroenteritis, are frequently similar to other health problems, so the link to pesticides may go undetected. People suffering from acute poisoning may lack access to medical care and may not even report the illness to the medical system. Health personnel may lack the training for recognizing pesticide poisoning or the means to report it to national authorities, which may themselves lack reporting systems. Moreover, it is difficult to associate chronic health effects with pesticides for several reasons. Chronic disease tends to result from lower exposure levels than do acute illnesses. There is a time lag between the exposure and the disease, and in individual cases it is usually impossible to make a firm link.



herefore we know very little about the chronic health impacts of pesticides and must rely on animal tests and epidemiological studies to understand what the magnitude of those effects might be.

The impact of an exposure to pesticides on human health depends on a number of factors, including the class of pesticide involved, the specific chemical and formulation, and the amount, route, timing and duration of the dose. The route of exposure can be via breathing, drinking or eating, or through the skin or mucous membranes. Other factors include the health of the person poisoned. Malnutrition and dehydration, for example, increase the sensitivity to pesticides. Children who are malnourished and dehydrated are at greater risk, and the risk for such children working in agriculture is still higher. Furthermore, where access to quality medical care is lacking, poisoning cases may go undiagnosed or untreated. Treatments such as antidotes and removal from the source of exposure may not be available.

Acute poisoning

Acute poisoning can cause a range of symptoms in adults and children, depending on the type of pesticide. For example, commonly used organophosphorus and carbamate compounds can produce neurobehavioral effects, such as fatigue, dizziness, and blurred vision; intestinal effects, such as nausea; respiratory effects, such as dry throat and difficulty with breathing; effects involving skin and mucous membranes, such as stinging eyes, itchy skin, and a burning nose; and muscular symptoms, such as stiffness and weakness.[7]

Acute pesticide poisoning can result in death, either rapidly or over the course of weeks, depending on the characteristics of the product and type of exposure.

Long-term health effects

Some health effects caused by pesticides only become apparent over a longer period of time. Controversy continues over the nature and severity of the health impacts from long-term exposure to pesticides. However, studies of laboratory animals, a growing body of epidemiological

research, and reported incidents involving human exposure to different doses of pesticides all support the following points:

Developmental and reproductive effects. Certain pesticides are believed to cause reproductive problems, such as spontaneous abortions, stillbirths, lower birth weights, birth defects and early neonatal deaths.[8, 9]

Endocrine disruption. Many pesticides have been shown to disrupt natural endocrine systems in pests, wildlife and laboratory animals. In small doses these pesticides are able to mimic or block hormones or trigger inappropriate hormonal activity. At high enough doses during critical times of development such exposures have the potential to interfere with important developmental and reproductive functions and may cause sterility, lowered sperm counts, cancer of the reproductive organs and other effects.[10]

Neurobehavioral effects. Impaired development of the nervous system can cause lowered intelligence and behavioral abnormalities. Although these impacts have not been studied in humans, exposure to certain pesticides in utero causes developmental and neurological

abnormalities in laboratory animals.[11] Certain organophosphorus compounds have caused long-term neurological disabilities in farm workers who have suffered acute poisoning.[12]

Carcinogenic effects. A number of pesticides cause cancer in laboratory animals, and several have been associated with cancer in humans. The concern for children is twofold. First, cancers in children, including leukemia, sarcomas, lymphoma, and brain cancer, have been associated with parents or homes that have been exposed to pesticides.[13] Second, people may face an increased risk of developing cancer during their lifetime if they have been exposed to carcinogens in their childhood.

Immunological effects. In animal experiments, certain pesticides have been proven to compromise the immune system. A weakened immune system, particularly in growing children, exacerbates the risk of infectious disease and cancer, thus increasing mortality rates. This would be especially menacing in developing countries, where children face greater exposures to infectious agents and may already have compro-

mised immune systems due to poor nutrition and other factors. [14] At present, there are no standardized tests for developmental immunotoxicity.

In many countries pesticides must undergo comprehensive toxicity testing. Even so, most pesticides have not been assessed for one or more hazards relevant to the health of children, especially developmental neurotoxicity and immunological effects. While unnecessary testing should be minimized, it is important to assure that risks to children are included in safety assessments of pesticides.[5]

General exposure – frequent and often unknowing

Pesticides are readily available and widely applied. They are used by farmers to spray crops and treat livestock. They are used in public health programmes, which can include indoor spraying of houses or public places. They are applied in all types of buildings, including schools. They are also used by trained applicators, maintenance workers, building residents, farmers and farm workers. The most hazardous pesticides should be applied only by professional applicators, but this may

not always be the case in developing countries. For indoor applications, adequate ventilation is essential, but not always practiced.

The use of pesticides can expose people to risks at different stages of the application process, from the purchase of products and the preparation and mixing of solutions to spraying, handling of pesticide-treated items and disposal.[1, 2] Protective equipment is often impractical in hot tropical climates and not affordable for many farmers.[15, 16]

Not only workers but nearby residents and children can be exposed to pesticides sprayed on fields. Field workers entering an area treated by pesticides often face a higher risk of harm, particularly if the time between application and entry is short and if they lack protective clothing. Older children and adolescents may be directly exposed as field workers, while younger children may be brought into treated fields to accompany their parents[3, 4, 17-22]

Work clothes often carry pesticide residues, exposing both workers and family members. Workers can be exposed for a prolonged time if they do not remove and wash clothes after each application

or spill. Clothing can occlude the skin, which enhances its ability to absorb pesticides. When clothes are brought home for laundering, those doing the washing are also exposed to the pesticides. Residues from laundering contaminate water and soil, further extending the chain of risk.[15] Clothing may also be purposely treated with pesticides; recently lindane was identified in shipments of leather from Africa.[23]

Pesticide spills are common and can occur at different stages and places, including manufacturing, processing, packaging, transport, storage, mixing, field application and disposal.

Once used or spilled, pesticides may contaminate water used for drinking or bathing. They can also pollute soil, either from agricultural use or as a result of spills during manufacturing and processing. Sediments in rivers, lakes and bays can be contaminated by runoff from pesticide production and use. Cleaning up contaminated water, soils, and sediments can be difficult and expensive and require years of treatment.

One of the most important sources of exposure is food residues. Growing food



on or near contaminated soil and using contaminated water on crops or for washing puts people – and children in particular – at risk.

Farmers and others may store pesticides in or around their homes where household members can accidentally gain access to them, or where these toxic substances can contaminate food or water that is stored nearby. Used pesticide containers are often reused to store water and food.

The greater vulnerability of children

Although exposure to pesticides may present a risk to all people, children generally face higher risks than adults. Children may be more susceptible than adults to certain pesticides, and they may be more greatly exposed than adults. They thus bear a disproportionate burden of risk and need additional protection.[5]

Children are often more exposed to pesticides. For example, when a mother is exposed to pesticides, the child often becomes exposed as well. Children may even be exposed to pesticides before birth, while still in the womb. This occurs when pesticides are transferred to the

Drinking Water

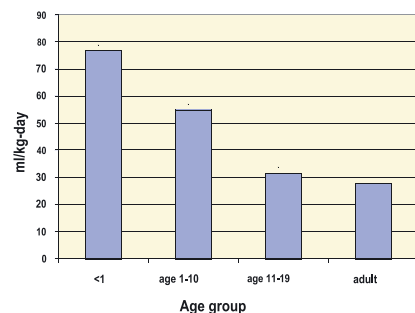


figure 1

Food

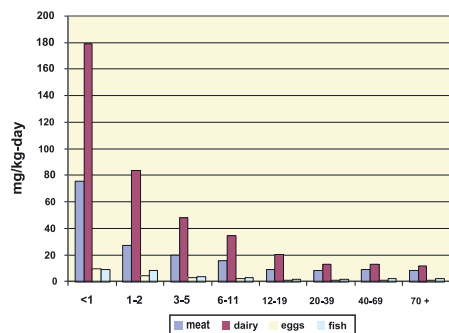


figure 2

Air

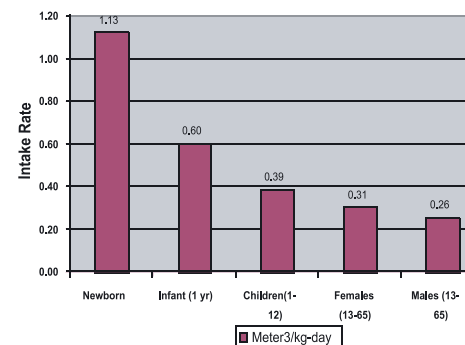


figure 3

Soil

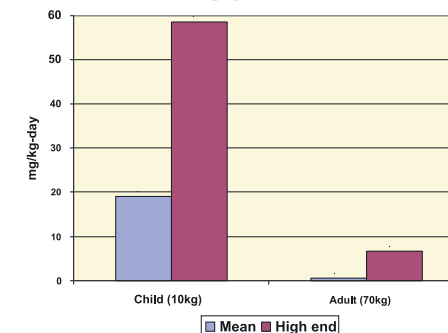


figure 4

fetus via the placenta.

During early infancy, children also come into contact with persistent and bio-accumulative pesticides that are passed on to them through breastfeeding. This can be a major source of exposure. Because breast milk is the best source of nutrition for infants and recommended by the World Health Organization, protecting mothers from exposure to toxic contaminants is crucial.[24]

As they grow, children drink more water, kilo for kilo, than do adults. Figure 1 shows the consumption of drinking water for several different age groups. As can be seen, infants under one year of age who are fed reconstituted infant formula consume more than twice as much water as adults. This means that, if the water contains residues of pesticides, infants will receive more than double the dose of pesticide as an adult drinking the same water.[25]

Children consume more food, per body weight, than do adults. Figure 2 shows US data on the consumption of various foods in which persistent and bio-accumulative pesticides may be present at high levels,

such as meat, milk, eggs and fish. Similarly, pesticides in fruits and vegetables are also passed on to children at high levels, including in processed foods.

Children may have completely different eating patterns than adults, making their potential exposure to pesticides even more disproportionate. Their diet is much less diversified, resulting in a larger relative consumption of certain foods. For example, in the US infants consume much more of certain fruits like apples per body weight than adults do. As a consequence, diet can be a major source of pesticide exposure for children, and greater relative to their size than for adults.[5]

Figure 3 compares daily breathing rates from several different age groups.[25] It shows that when pesticide residues are present in the air or in airborne dust, infants can receive higher doses than older children and adults. In addition, children play closer to the ground, where many pesticides may be present at higher concentrations.

Children behave and play differently than adults, resulting in greater potential expo-

sure to pesticides. In addition to playing closer to the ground, children may be exposed to more pesticides in dusts and soils due to normal hand-to-mouth activity; figure 4 compares the amount of soil eaten each day by children and adults.[25] Children frequently put toys or other objects into their mouths as well, and as a consequence may receive significant doses of pesticides from contaminated objects, such as those found in agricultural areas, homes or gardens.

Because children have different metabolisms than adults, they may have different capacities for breaking down or metabolizing, excreting, activating or deactivating pesticides. Such processes change dramatically from birth until adulthood. These factors can cause pesticides to have more pronounced toxic effects in children, or possibly lead to somewhat different poisoning symptoms than those seen in adults.

Poverty can put children in a number of potentially high-risk situations. Children may help out on family-owned farms where pesticides are used. They may work for local concerns, carrying goods

treated with pesticides. The result can be even higher exposure to pesticides. Pesticide-related illnesses in children employed in farm work have been documented in many countries.[3, 4]

High-risk exposure scenarios for children

The fact that children will receive higher doses of pesticides compared to adults may be of particular concern in certain situations. These include the consumption of fish and other food that is highly contaminated with pesticides, subsistence farms that use large quantities of pesticides, and pesticide-spraying programmes. For example:

- Indoor pesticide sprays, fogs or dusts can be misapplied, creating hazardous levels of pesticides in the air and the build-up of pesticides in foam articles such as bedding and children's toys.[26]
- Mispackaged pesticides can lead to children accidentally ingesting pesticides.[27] The most hazardous pesticide packages are bottles that look like those containing soft drinks or other beverages.

- Highly toxic pesticides may be viewed by older children as a convenient means of attempting suicide.[28]
- Highly concentrated and acutely toxic pesticides can cause severe illness or death even if ingested in very small quantities – for example, a single swallow.[29] Concentrates are also hazardous around the home because they must be reconstituted in another container, one that may be easily confused as being safe by a young child.
- Household pesticide contamination (caused by insecticides that are used for sanitation or vector control, carried into the home by parents or tracked into the house through contaminated soil) can be especially hazardous to children who display “pica” behavior. Such young children have a propensity for peeling off and eating paint chips, wallpaper, and other materials; it is most common among children with a nutritional deficiency – the same children who are likely to be more vulnerable to the effects of toxic pesticides. Such children would thus be more exposed to DDT and other pesticides sprayed on the walls.

- Pesticides can contaminate nearby groundwater and surface-water. Contaminated water is more likely to be consumed by small children, who tend to drink water from any source.
- Locally grown food may not be properly monitored or controlled for residues of pesticides. Because food sold at the farm gate often has higher residue levels than food distributed later, families who eat directly from fields may have higher pesticide exposures.
- Containers for pesticides in low-income countries and areas are often used and re-used for other purposes, including storing and transporting food and water.
- Grain storehouses are continually treated with rodenticides to limit crop losses. Bait can easily be mistaken for normal grain, which is particularly dangerous for children because they have little protection against most rodenticides. Looting of baited grain by children from families with low incomes can lead to severe poisonings.
- Pesticides are too often stored in households where they are in easy reach of children.[16, 30]

Exposure in urban settings

In developing countries, the marketing of pesticides is sometimes uncontrolled or illicit. Misbranded or unlabelled formulations, including ready-made solutions in soft drink bottles and other unlabelled liquid containers, are sold at open stands. Industrialized countries have also experienced the fraudulent marketing of agricultural pesticides for indoor use, which causes children to face further exposures.[31]

Exposure in rural settings

Soil is contaminated by pesticides sprayed on neighboring fields or spilled near living quarters while equipment is being filled.

Contaminated equipment is left after working hours near areas used by children for playing.

Family members working with spraying equipment do not wash and change their clothes after work or they leave their contaminated clothes lying around.[32]

Spraying of field pesticides occurs close to living quarters or drifts into neighboring fields, homes, or schools.[4, 33]



Spraying of pesticides for vector control in interior spaces, including living quarters, takes place regularly, and reentry times are not observed. Some pesticides break down slowly, and exposure continues despite the observance of re-entry times.

Infants who are still being breastfed are carried by their mothers in the fields during spraying operations. Older children are allowed to play around treated fields.

Pesticides or ready-to-use solutions are kept in the home in unlabelled containers or are labelled in a language other than the local one. Illiteracy compounds the risk of exposure.

Exposure and developing countries

Many situations involving pesticide exposure are linked to education and certain socio-economic conditions. These conditions tend to occur more often in developing countries, thus resulting in increased risk to children.[34]

Stockpiles of unwanted or obsolete pesticides, which are unprotected and uncontrolled and often lack legible labeling,



may be found close to living quarters or to areas where children play or work.

Seeds coated with pesticide for planting, or pesticide-treated grains for use as bait, are often stored without proper labeling and protective measures. In times of economic stress or food shortage, people may be tempted to eat such seeds.

Any spraying equipment used by subsistence farmers tends to be low-end technology. Manual equipment used by an individual results in imprecise spraying and substantial drift of pesticides to nearby living quarters.

Pesticide users, including teenagers, may lack access to protective equipment such as gloves and masks, which is required to assure the safety of the pesticide product.[16]

Pesticide users, particularly on subsistence farms, often lack access to training. This can lead to pesticides being used carelessly, including in the presence of children.[15]

The lack of education for girls has particularly significant consequences. When girls grow up they go on to shoulder responsibilities for household chores, water provision, education of family members, and work in agriculture and other areas where pesticides play a role.

Excerpt from Final Report of Fourth Session of Intergovernmental Forum on Chemical Safety,

Bangkok, Thailand, 1-7 November 2003

Children and chemical safety

1. When assessing the protection of children, consideration should be given to chemical exposures that can occur during preconception, throughout gestation, infancy, childhood and adolescence.

2. Governments should prepare, through multi-stakeholder consultation, initial national assessments of children's environmental health and chemical safety. These assessments should identify the priority concerns and provide a basis for developing action plans to address those concerns. Governments should provide a progress report to Forum V.

WHO is requested to develop, through multi-stakeholder consultation, guidance tools, and to assist at least three countries in different stages of economic development in each region to prepare the assessment and action plans by 2006.

3. Governments, with support from stakeholders, particularly WHO and UNICEF, should promote education and training on children's chemical safety, and where risks are identified, governments and stakeholders should commit to taking action to prevent or reduce exposure. Governments should also promote harmonized data collection, research, legislation and regulations, and consider the use of indicators of children's environmental health, and report back to Forum V in 2006.



Governments should, when setting acceptable levels or criteria related to chemicals, take into consideration the potential enhanced exposures and/or vulnerabilities of children.

4. WHO is requested to support, collaborate with, and coordinate among research organizations and those supporting research (such as the European Commission, Science NGOs, the Global Health Research Forum, governments and others) to develop mechanisms to facilitate collaborative national and international research and share technology.

5. Governments and stakeholders should commit to sharing information on options for taking effective action to protect children from established chemical threats and from chemical risks where there is a degree of uncertainty. WHO is requested to convene a multi-stakeholder meeting to explore the mechanisms for collecting data and disseminating information that could be used to reduce uncertainty in risk assessment.

6. In addition, Forum IV requests the IFCS President to convey these recommendations to other meetings and fora.

In carrying out the recommendations set out in this priority, the stakeholders concerned should be guided by the full decision document and companion information paper that were developed by the Forum Working Group.



What can be done to prevent pesticide poisoning of children?

Strategies to prevent pesticide poisoning must be designed for local conditions while drawing support from the national and international levels. These strategies should be sensitive to differing cultural, political, economic, technological and development circumstances.

At the local level

The risks posed by pesticides can be best avoided by minimizing the use of pesticides, especially the most hazardous ones, and by taking measures to reduce exposures where it is not practical to eliminate use altogether. Everyone responsible for caring for children or who is involved with pesticide use should be aware of the problems caused by pesticides and be encouraged to:

- Reduce and eliminate possible sources of pesticide exposures to children (in food, water, dust, and soil and in the home and the work environment).
- Reduce unnecessary uses of agricultural pesticides by adopting strategies that can reduce pesticide use, such as integrated pest management and crop rotation. Where pesticides are needed, encourage the use of safer pesticides.
- Keep pesticides out of children's reach and store them securely in containers that do not resemble those used for food or drinks, are properly labeled and use child-proof tops. Do not store any highly toxic pesticides or pesticide concentrates in the home.[35]

- Ensure hygienic conditions, especially when storing food and water, and wash food prior to eating it.
- Minimize the unnecessary use of pesticides around children by practicing integrated pest management in homes and schools. Where pesticides are used, strictly follow instructions about application rates and re-entry intervals.[35]
- Health care providers need to know how to recognize and treat cases of pesticide poisoning. They can also help to educate farmers and others about the adverse effects of pesticides and how to prevent pesticide exposures, and they should document and report any cases of pesticide poisoning.
- Pesticide users and their families need to be better educated about how to recognize, prevent and treat pesticide poisoning, in particular mothers with small children who live in areas where pesticide exposures may be high. Such information could be included in school curricula.
- Where hazardous pesticides are used, communities need a cadre of trained pesticide applicators so that the pesticides will

be used in the safest manner possible. Pesticides that have restrictions for use, such as requirements for special protective gear, should only be applied by such trained professionals.

- Pesticide manufacturers and governments should follow the voluntary FAO International Code of Conduct on the Distribution and Use of Pesticides. The Code outlines measures for ensuring the safety of pesticides through the testing, manufacturing, advertising, labeling, and distribution phases.[36] It calls on manufacturers to supply information and instructions in a form and language adequate for ensuring safe and effective use. It also asks them to retain an active interest in following their products to the ultimate consumer, keeping track of major uses and any problems that may arise during the actual use of their products. This information can then be used for determining whether any changes are needed in labeling, directions for use, packaging, formulation or product availability.



At the national level

Pesticides can pose risks anywhere in the world. The problem is greatest, however, in developing countries where low retail prices promote pesticide use but weak legislation and inadequate law enforcement fail to control risks. Such countries should establish systems for collecting data on cases of pesticide exposure. A number of software systems are readily available for this purpose, including the INTOX Programme produced by the International Programme on Chemical Safety (IPCS).

Awareness of pesticide risks and how to manage them should be promoted through information and education campaigns, including via television and radio programs. Risks related to pesticide production may not be relevant in many developing countries, but in those countries that do have manufacturers, weaker laws and enforcement may increase the likelihood that workers and nearby communities could be exposed.

The OECD has documented the fact that the riskiest type of chemical products are often exported from industrialized to developing countries. Moreover, businesses that are involved in formulation of pesticides are more common in developing countries than pesticide manufacturers; pesticide formulation has serious potential for risks to health and the environment, unless adequate safeguards are taken.

The following sections of the voluntary **FAO International Code of Conduct on the Distribution and Use of Pesticides** are particularly applicable to actions on the national level:

FAO International Code of Conduct on the Distribution and Use of Pesticides

3. Pesticide management

3.1 Governments have the overall responsibility to regulate the availability, distribution and use of pesticides in their countries and should ensure the allocation of adequate resources for this mandate.

3.2 Pesticide industry should adhere to the provisions of this Code as a standard for the manufacture, distribution and advertising of pesticides, particularly in countries lacking appropriate legislation and advisory services.

3.3 Governments of pesticide exporting countries should, to the extent possible:

3.3.1 provide technical assistance to other countries, especially those lacking technical expertise in the assessment of the relevant data on pesticides;

3.3.2 ensure that good trading practices are followed in the export of pesticides, especially to those countries with limited or no regulatory schemes.

3.4 Pesticide industry and traders should observe the following practices in pesticide management, especially in countries without legislation or means of implementing regulations:

3.4.1 supply only pesticides of adequate quality, packaged and labelled as appropriate for each specific market (3);

3.4.2 in close cooperation with procurers of pesticides, adhere closely to provisions of FAO guidelines on tender procedures (4);

3.4.3 pay special attention to the choice of pesticide formulations and to presentation, packaging and labelling in order to reduce risks to users and minimize adverse effects on the environment;

3.4.4 provide, with each package of pesticide, information and instructions in a form and language adequate to ensure effective use and reduce risks during handling;

3.4.5 be capable of providing effective technical support, backed up by full product stewardship to field level, including advice on disposal of pesticides and used pesticide containers, if necessary;

3.4.6 retain an active interest in following their products to the end-user, keeping track of major uses and the occurrence of any problems arising from the use of their products, as a basis for determining the need for changes in labelling, directions for use, packaging, formulation or product availability.

3.5 Pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available should be avoided, especially in the case of small-scale users in tropical climates. Preference should be given to pesticides



that require inexpensive personal protective and application equipment and to procedures appropriate to the conditions under which the pesticides are to be handled and used.

3.6 National and international organizations, governments and pesticide industry should take coordinated action to disseminate educational materials of all types to pesticide users, farmers, farmer organizations, agricultural workers, unions and other interested parties. Similarly, users should seek and understand educational materials before applying pesticides and should follow proper procedures.

3.7 Concerted efforts should be made by governments to develop and promote the use of IPM. Furthermore, lending institutions, donor agencies and governments should support the development of national IPM policies and improved IPM concepts and practices. These should be based on scientific and other strategies that promote increased participation of farmers (including women's groups), extension agents and on-farm researchers.

3.8 All stakeholders, including farmers and farmer associations, IPM researchers,

extension agents, crop consultants, food industry, manufacturers of biological and chemical pesticides and application equipment, environmentalists and representatives of consumer groups should play a proactive role in the development and promotion of IPM.

3.9 Governments, with the support of relevant international and regional organizations, should encourage and promote research on, and the development of, alternatives posing fewer risks: biological control agents and techniques, non-chemical pesticides and pesticides that are, as far as possible or desirable, target-specific, that degrade into innocuous constituent parts or metabolites after use and are of low risk to humans and the environment.

3.10 Governments and the application equipment industry should develop and promote the use of pesticide application methods (6, 7) and equipment (8, 9, 10, 11) that pose low risks to human health and the environment and that are more efficient and cost-effective, and should conduct ongoing practical training in such activities (12).

3.11 Governments, pesticide industry and national and international organizations should collaborate in developing and promoting resistance management strategies to prolong the useful life of valuable pesticides and reduce the adverse effects resulting from the development of resistance of pests to pesticides.

4. Testing of pesticides

4.2 Each country should possess or have access to facilities to verify and exercise control over the quality of pesticides offered for sale or export, to establish the quantity of the active ingredient or ingredients and the suitability of their formulation, according to FAO or WHO specifications, when available.

5. Reducing health hazards

5.1 Governments should:

5.1.1 implement a pesticide registration and control system along the lines set out in Article 6;

5.1.2 periodically review the pesticides marketed in their country, their acceptable uses and their availability to each sector of the public, and conduct special reviews when indicated by scientific evidence;

5.1.3 carry out health surveillance programmes of those who are occupationally exposed to pesticides and investigate, as well as document, poisoning cases;

5.1.4 provide guidance and instructions to health workers, physicians and hospital staff on the treatment of suspected pesticide poisoning;

5.1.5 establish national or regional poisoning information and control centres at strategic locations to provide immediate guidance on first aid and medical treatment, accessible at all times;

5.1.6 utilize all possible means for collecting reliable data and maintaining statistics on health aspects of pesticides and pesticide poisoning incidents, with the objective of establishing the WHO harmonized system for identifying and recording such data (25). Suitably trained personnel and adequate resources should be made available to ensure the accuracy of information collected;

5.1.7 provide extension and advisory services and farmers' organizations with adequate information about practical IPM strategies and methods, as well as the range of pesticide products available for use;

5.1.8 ensure, with the cooperation of pesticide industry, that where pesticides are available through outlets which also deal in food, clothing, medicines or other products for consumption or topical application, they are physically segregated from other merchandise to prevent contamination and/or mistaken identity. Where appropriate, they should be clearly marked as hazardous materials. Every effort should be made to publicize the dangers of storing foodstuffs and pesticides together;

5.1.9 utilize all possible means for collecting reliable data, maintaining statistics on environmental contamination and reporting specific incidents related to pesticides;



5.1.10 implement a programme to monitor pesticide residues in food and the environment.

5.3 Government and industry should cooperate in further reducing risks by:

5.3.1 promoting the use of proper and affordable personal protective equipment;

5.3.2 making provisions for safe storage of pesticides at both warehouse and farm level;

5.3.3 establishing services to collect and safely dispose of used containers and small quantities of left-over pesticides;

5.3.4 protecting biodiversity and minimizing adverse effects of pesticides on the environment (water, soil and air) and on non-target organisms.

6. Regulatory and technical requirements:

6.1 Governments should:

6.1.1 introduce the necessary legislation for the regulation of pesticides and make provisions for its effective enforcement, including the establishment of appropriate educational, advisory, extension and health-care services, using FAO guidelines as far as possible (2, 29, 30). In so doing, they should take full account of local needs, social and economic conditions, levels of literacy, climatic conditions and availability of appropriate pesticide application and personal protective equipment;

6.1.2 strive to establish pesticide registration schemes and infrastructures under which products can be registered

prior to domestic use and ensure that each pesticide product is registered before it can be made available for use (29, 30, 31);

6.1.3 conduct risk evaluations and make risk management decisions based on all available data or information, as part of the registration process;

6.1.8 collect and record data on the import, export, manufacture, formulation, quality, quantity and use of pesticides in order to assess the extent of any possible effects on human health or the environment, and to follow trends in pesticide use for economic and other purposes;

7. Availability and use

7.1 Responsible authorities should give special attention to drafting rules and regulations on the availability of pesticides. These should be compatible with existing levels of user training and expertise. The parameters on which such decisions on availability are based vary widely and must be left to the discretion of each government.

7.2 In addition, governments should take note of and, where appropriate, use the WHO classification of pesticides by hazard (34) as the basis for their regulatory measures and associate the hazard class with well-recognized hazard symbols. When determining the risk and degree of restriction appropriate to the product, the type of formulation and method of application should be taken into account.

7.3 Two methods of restricting availability can be exercised by the responsible authority: not registering a product or, as a condition of registration, restricting the availability to certain groups of users in accordance with a national assessment of the hazards involved in the use of the product.

7.4 Governments and industry should ensure that all pesticides made available to the general public are packaged and labelled in a manner which is consistent with the FAO guidelines on packaging and labelling (3) and with appropriate national regulations.

7.5 Prohibition of the importation, sale and purchase of highly toxic and hazardous products, such as those included in WHO classes Ia and Ib (34), may be desirable if other control measures or good marketing practices are insufficient to ensure that the product can be handled with acceptable risk to the user.

8. Distribution and trade

8.1 Governments should:

8.1.1 develop regulations and implement licensing procedures relating to the sale of pesticides, so as to ensure that those involved are capable of providing buyers with sound advice on risk reduction and efficient use (26);

8.1.2 take the necessary regulatory measures to prohibit the repackaging or decanting of any pesticide into food or beverage containers and rigidly enforce punitive measures that effectively deter such practices;



At the regional and international level

Although all pesticides should be considered as being potentially hazardous to human health, some groups of pesticides are of particular concern internationally. National governments and intergovernmental organizations are carrying out a number of activities to reduce the adverse health and environmental impacts of pesticides.

Pesticides with high acute toxicity: Ia, Ib, and II Chemicals

The World Health Organization (WHO) classifies most pesticides mainly on the basis of acute toxicity studies of animals. Pesticides are classified as extremely hazardous (Ia), highly hazardous (Ib), moderately hazardous (II), slightly hazardous (III) and unlikely to be hazardous under normal use (no class number assigned). For some class Ia pesticides, just 5 ml (a teaspoon) taken into the mouth is sufficient to kill an adult human being.

Small-scale farmers in the tropics use large amounts of pesticides belonging to classes Ia, Ib, and II. For example, in Indonesia in 1995, 44 percent of the 265 registered pesticides were Class Ia, Ib, or II; one field study revealed that 50 percent of pesticides used by farmers belonged to these classes.

Adding to the risk is the fact that small-scale farmers in developing countries typically cannot afford protective clothing. Even if available, protective garb used under tropical conditions is hot and uncomfortable at best, and can lead to heat stress. Thus, it is unlikely to be used.

Epidemiology of acute pesticide poisonings

The unsafe use of pesticides represents a problem for human health in both developed and developing countries. Although the adverse effects of pesticides on human and environmental health have been studied in almost every country, controversy continues about the extent and severity of poisonings. The primary reason for the controversy is the limited scope of past reports and studies.

The International Programme on Chemical Safety (IPCS) has initiated a project that will provide reliable and updated information on the extent of the problem and make it possible to compare epidemiological data among various study populations. Data from different health sources and study sites are being collected, and countries are being given guidance on how to strengthen their national data collection systems and promote prevention and education. These activities are designed to reduce the incidence and severity of poisonings and their adverse effects.



Persistent Organic Pollutants – Pesticides

Another group of pesticides of particular concern is persistent organic pollutants (POPs). These pesticides are toxic; persist for long periods in the environment; travel long distances via air, water and living creatures; and are found in areas where they were never used or produced. They store easily in fatty tissues and build up in food chains.[37] Children may be exposed to these pesticides when still in the womb and during breastfeeding. (However, breast milk is the preferred source of nutrition for young infants.)

Responding to mounting concern, governments adopted a legally binding treaty in 2001 under the auspices of the United Nations Environment Programme at reducing and eliminating a starting list of 12 POPs. Nine are pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, toxaphene, and hexachlorobenzene (the later is also an industrial chemical).

Pesticides under the Rotterdam Convention

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in September 1998. [38] The Convention has been signed by 73 countries, and its goals are being pursued on a voluntary basis through the interim PIC procedure until the agreement enters into force. The Convention entered into force on 24 February 2004.

The Rotterdam Convention establishes a first line of defence against future tragedies by giving importing countries the power to decide which potentially hazardous chemicals they want to receive and to exclude those they cannot manage safely. When trade is permitted, requirements for labelling and providing importers with information on potential health and environmental effects will promote the safe use of the chemicals.

The Convention starts with 22 pesticides and five other chemicals; many more

substances are likely to be added in the future. All of the listed chemicals have been banned or severely restricted by countries to protect human health and the environment. The list includes severely hazardous pesticide formulations that can cause problems under the conditions of use in developing countries and countries with economies in transition.

For further information, see the Rotterdam Convention website www.pic.int.



Activities of International Organizations

United Nations Environment Programme (UNEP)

UNEP/Chemicals is the focus for all activities on the sound management of hazardous chemicals. Its aim of protecting human health and the environment from the negative impacts of toxic chemicals is pursued by:

- Jointly with FAO, providing the secretariat for the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;
- Providing the secretariat for the Stockholm Convention on Persistent Organic Pollutants (POPs);
- Catalyzing actions to help governments address risks from toxic chemicals;
- Promoting the world-wide exchange of information on toxic chemicals; and
- Providing training and capacity building to countries in the sound management of chemicals.

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Food and Agriculture Organization of the United Nations (FAO)

FAO assists member countries to improve the sound management of chemicals by:

- Promoting the provisions of the Code of Conduct on the Distribution and Use of Pesticides and providing technical assistance on implementing rational plant-protection programmes and preventing and disposing obsolete and unwanted pesticides;
- Jointly with IAEA, improving the use of agrochemicals in food and agriculture;
- Jointly with UNEP providing the Secretariat for the Rotterdam Convention;
- Jointly with WHO, making recommendations for Acceptable Daily Intakes of food additives, pesticide and veterinary drug residues, and Maximum Residue Limits in food for pesticides and veterinary drugs and tolerable intakes of other food contaminants; and
- Providing the Secretariat for the Joint FAO/WHO Codex Alimentarius Commission, the executive organ of the joint FAO/WHO Food Standards Programme.

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World Health Organization (WHO).

WHO's work in chemical safety is undertaken largely through the International Programme on Chemical Safety (IPCS), a joint programme of WHO, UNEP and the International Labour Organization (ILO). At WHO headquarters, the Programme for the Promotion of Chemical Safety is the Central Unit for IPCS, with dual responsibilities for technical work and coordination. WHO also coordinates IPCS activities with other WHO programmes featuring chemical safety components, such as the International Agency for Research in Cancer (IARC), food safety, occupational health, and control of tropical diseases.

Areas of activity include:

- Evaluation of risks to human health and the environment;
- Methodologies for risk assessment;
- Prevention and management of toxic exposures and chemical emergencies;
- Exchange of information on chemical safety and communication of related hazards and risks; and
- Capacity building for sound management of chemicals and risk reduction.

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