

# Understanding the Impacts of Pesticides on Children:

A discussion paper

January 2018

# Acknowledgements

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# Key Facts

Children are more vulnerable to the effects of pesticides



If exposed to aerially sprayed pesticides, children will inhale

**double the amount**

of an average adult.



Due the small size of liver and kidneys, the same amount of a chemical is likely to be

**10 times more toxic**

to a child than to an adult

Consequences for the child's health

Public Health

## Pesticides



Insecticide



Rodenticides



Bactericide/  
disinfectant



Fungicides



Herbicides

Child exposure

Developing countries experience

**99%**

of the deaths linked to pesticides

Smallholder farmers produce

**80%**

of the food in Asia and Sub-Saharan Africa

## Child labour

In 2010

The agricultural sector accounted for

**71%** of all child labour

**108 million** children



engaged in agricultural work

**1.5 billion** people

Live in smallholder farming households

## From mother to child



Through blood, placental tissue and breast milk



Application of insect repellents on skin or scalp



Ingestion of contaminated fruits and vegetables



Directly or indirectly working with pesticides



Environmental exposure through soil, air and water



Chemicals stored near the home or dumped in public areas



Prenatal

0-4 years

5-14 years

**Fetal death and birth defects:**

- Stillbirths
- Increased risk of fetal death
- Risk of spontaneous abortion

**Endocrine-system disruption:**  
Prenatally or during crucial stages of development

**Cancer:**  
Childhood hematopoietic cancers and increased chances of brain tumours

**Neurodevelopment:**

- Delays up to two years
- Deficits in motor speed, coordination and visual memory

Severe lack of research and data

In 2010

global estimates of acute pesticide poisoning ranged from 1 million to 41 million people affected annually.





## Pesticides and children: Introduction to the discussion

With the population projected to reach almost 10 billion by 2050, the world's agricultural demand is expected to increase by 50 per cent compared to 2013.<sup>1</sup> As the risks of climate change threaten agricultural stability and cash crops remain in high demand, pesticides are being used at exponentially increasing rates, generating international concern for environmental and health risks.

An estimated 1.1 billion people were engaged in agriculture as of 2013, representing 31 per cent of global employment. While the overall percentage of people working in the sector has declined significantly since 1991, more than 60 per cent of the sub-Saharan labour force remains engaged in agriculture.<sup>2</sup> Due to factors such as high poverty in many agricultural areas, the sector accounted for 71 per cent of all child labour in 2016, exposing 108 million girls and boys to frequently hazardous working conditions,<sup>3</sup> including direct contact with pesticides. One of the most persistent barriers to assessing the impact of exposure to pesticides is the

severe lack of research and data.<sup>4</sup> In 2010, the Pesticide Action Network found that global estimates of acute pesticide poisoning ranged from 1 million to 41 million people affected annually.<sup>5</sup> As stated in 2017 by the United Nations Special Rapporteur on the right to food: *"There are no reliable, global statistics on the number of people who suffer from pesticide exposure."*<sup>6</sup>

There is no question, however, that people are being exposed to dangerous pesticides, and that the poorest and most vulnerable – particularly children – are suffering disproportionately.

### About this paper

Although pesticides can have many benefits to society, they can also have an adverse effect on the health and development of children, particularly in the world's most fragile communities. Lack of awareness, poor management practices and incorrect disposal exacerbate and increase the environmental

pathways of children's pesticide exposure. But soil, air and water are not the only way these potentially dangerous chemicals reach children: They may also be exposed during gestation, through their mother's breast milk, and while labouring in the fields.

*Understanding the Impacts of Pesticides on Children* highlights the various pathways of exposure and outlines the associated effects on children's health. This discussion paper summarizes key research (with footnotes that offer links to freely available external resources), delves into the issues, and offers concrete ideas for solutions.

Given the lifelong effects that poor pesticide management has on children, it is urgent that public and private sector actors work together to reduce the negative impacts – joining forces to promote awareness and education, advance data collection and analysis, establish effective regulation and monitoring mechanisms, and encourage and enforce more productive and safer farming techniques.

With this in mind, this paper aims to serve as a background and foundation for continued dialogue and invites all stakeholders to engage in developing viable recommendations for improved policies and practices that respect and support children's rights.

## **Pesticides and public health**

The deadly illnesses spread by rodents, insects such as mosquitoes and ticks, and other pests pose significant risks to public health, including vector-borne infectious diseases such as malaria, dengue, Zika, West Nile virus, Lyme disease and rabies. Microorganisms such as bacteria, viruses and protozoans can cause contamination in homes, hospitals and food-processing facilities.

Pesticides have thus been found to have a vital role in protecting people from these devastating health risks. For example, UNICEF and the World Health Organization (WHO) recommend the use of insecticide-treated mosquito nets to control the spread of malaria, which killed approximately 438,000 people in 2015, 70 per cent of them children under age 5.<sup>7</sup> In response to the recent Ebola outbreak in Liberia, liberal application of disinfectants was required to help control its spread. Some pesticides, especially persistent organophosphates such as DDT, have been regulated for public-health use only and are banned from agricultural use. The use of pesticides for their positive effects – particularly for public health – must be carefully balanced by effective regulation and enforcement.

This paper aims to serve as a foundation for continued dialogue and invites all stakeholders to engage in developing viable recommendations for improved policies and practices that respect and support children's rights.

## Global drivers in pesticide use

The world population is becoming ever more urbanized and frequently wealthier, leading to discretionary changes in diet, such as greater consumption of meat and milk products, as well as increased demands for the staple foods that sustain life and basic health. As natural habitats are transformed or destroyed through deforestation for agriculture and other human activities, pests are expected to increase; environmental issues such as climate change are simultaneously projected to increase the resistance of pests and the introduction of new pests to crops.<sup>8</sup>

In many areas of the world, there are both chronic and acute needs to stave off famine, undernutrition and lack of access to food. Children need diverse and sufficient food for survival and growth, and the proliferation of pesticide use is, in part, an attempt to boost crop yields and meet the needs of an ever-escalating population. However, it is possible to achieve safer and more sustainable food production and distribution by developing resilient systems through agroecology, and providing farmers with education on integrated pest management techniques.

There is growing evidence that unregulated pesticide use and lack of enforcement mechanisms are increasing the risk of adverse health effects and environmental contamination, particularly in developing countries.<sup>9</sup> While these countries use only 25 per cent of the world's pesticides, they experience 99 per cent of the deaths linked to pesticides.<sup>10</sup> Factors that drive the use of pesticides among smallholder farmers – who produce around 80 per cent of the world's food<sup>11</sup> – include limited availability of education for pesticide management and advice on alternative methods; subsidies and foreign government donations; and the informal market in 'discount', often illegal, pesticides.<sup>12</sup>









## Vulnerability: Children face exceptional risks

As deftly described in a Pediatrics technical report, “Children are uniquely vulnerable to uptake and adverse effects of pesticides because of developmental, dietary, and physiologic factors. Exposure occurs through ingestion, inhalation, or dermal contact. Unintentional ingestion by children may be at a considerably higher dose than an adult because of the greater intake of food or fluids per pound of body weight. Children exhibit frequent hand-to-mouth activity, and this is an important source of increased exposure in comparison with adults.”<sup>13</sup>

Children undergo rapid growth and development, facing specific ‘windows of vulnerability’,<sup>14</sup> the critical stages in early development when toxic exposure can cause devastating injury. During the first 12 years of life, a child’s breathing rate is double that of an adult’s: If exposed to aerially sprayed pesticides, they will inhale double the amount.<sup>15</sup> Though children often eat and drink more relative to their body weight than adults, their liver and

kidneys do not have adult capacities to remove pesticides from the body, thus increasing the risk of retaining toxins. Due to their relatively small size, the same amount of a chemical is likely to be 10 times more toxic to a child than to an adult.<sup>16</sup>

### Pathways of exposure

Children are vulnerable to pesticides from the moment of conception and throughout the development phase as a fetus, reflected in the term ‘born pre-polluted’, which is widely used to show the impact on children and their rights. This section traces the exposure paths<sup>17</sup> from mother to child, at home and at play, toxic residues on food and child labour.

In the course of a typical day, the tasks and patterns of farming families contribute to their children’s exposure to pesticides originating in drift from farmlands, deposited on indoor surfaces (furniture, doors, windows), residuals

on foliage and soil, adhering to vehicles (motorcycles, bicycles) and dissolving in water to contaminate irrigation systems, rivers and streams.<sup>18</sup> The table below lists other pathways, according to children's age:

**From mother to child:** As noted in a report by the United States Department of Health and Human Services, in 2010, higher levels of toxic and hormone-disrupting substances are frequently found in women, compared to men – including in the blood, placental tissue and breast milk of pregnant women and mothers with newborns.<sup>19</sup> DDT, which can potentially remain in soil for hundreds of years, has been detected in amniotic fluid, placentas, umbilical cord blood, fetuses and breast milk.<sup>20</sup>

Among all reproductive-age farm workers, pesticide exposure levels are consistently higher than those in the general population,<sup>21</sup> and there are more women than men working in agriculture. Several studies have suggested that maternal occupational exposure is associated with leukaemia, birth defects and other diseases, as well as with neonatal mortality.<sup>22</sup>

**At home and at play:** A common form of direct exposure for children is the unsafe use of insecticides and rodenticides in the home. Children may also come in contact with extremely hazardous, obsolete pesticides when the chemicals are stored near living quarters or dumped in public areas – both of which are banned practices but often occur due to lack of information, awareness and enforcement mechanisms. The risk of coming into contact with dangerous chemicals through play is quite high in developing countries, particularly in rural areas.<sup>23</sup>

Areas and regions where farmland or agricultural land and family living quarters are in close proximity are at greatly increased risk of exposing children to pesticides. When pesticides are managed poorly, stored improperly or allowed to run off causing environmental contamination or degradation, they affect not only the farmers and children working directly with them, but also the whole community.

**Toxic residues in food:** Children in all communities and countries are exposed to pesticides through ingesting fruits and vegetables, despite laws and policies to keep the maximum residue levels low. Studies conducted by the Thai Pesticide Action Network, in 2016, found residues of multiple hazardous pesticides that are banned in Thailand on fruits and vegetables in local markets and supermarkets at rates ranging from 35 per cent up to 100 per cent.<sup>24</sup>

**Child labour:** With 108 million girls and boys engaged in agricultural work,<sup>25</sup> the sector has the highest incidence of both unpaid child labour and early entry into the workforce, including children 5–7 years old.<sup>26</sup> Agriculture is one of the three most dangerous sectors to work in regarding occupational diseases, and 59 per cent of the 68 million children engaged in hazardous work are in this sector.<sup>27</sup> A survey on child labour in the cocoa industry, in 2002, found that 284,000 children were working in the industry, including through forced labour, and 153,000 of them sprayed pesticides without any protective equipment.<sup>28</sup> In the cotton industry, six of the seven top cotton producers have been reported to use child labour, with forced labour a common occurrence.<sup>29</sup>





## Pathways of exposure to pesticides by age



Pathways of exposure		Prenatal	0-4 years	5-14 years	14-18 years
Through mother/father	Father's sperm at time of conception				
	Trans-placental exposure through the mother				
	Breast milk				
	Children on mother's back while the mother works in fields that have recently been sprayed with pesticides				
	Parents' clothing laden with pesticides				
	Parents not washing themselves after working with chemicals and picking up their children				
At home or school	Children using discarded pesticide				
	Application of insect repellents directly on skin or scalp				
	Storage of pesticides inside the home and within the reach of children				
	Pesticides sprayed on school lawns or gardens, or inside schools to treat rodents and insects				
	Pesticide residues on food or toys				
	Indoor application of pesticides to treat rodents, insects or bedbugs				
	Indoor air laden with pesticides				
	Accidental ingestion of pesticides stored in the home due to hand-to-mouth behaviour				
	Wood preservation pesticides in public and school playgrounds				
	Washing pesticide laden clothing				
	Purposeful ingestion of pesticides (suicide)				
Environment	Pesticides in nearby water sources where children play				
	Improper disposal of pesticides in public areas				
	Pesticides in drinking or swimming water				
	Long-range transport of pesticides				
	Environmental exposures of pesticides through water, air and soil				
	Walking barefoot in or near agricultural runoff				
	Direct contact or exposure through labour in agricultural fields or runoff areas, either applying pesticides directly or working to pick up leaves shortly after they have been sprayed				

## Impacts on children's health

Children are especially vulnerable to toxins due to their physiology, behaviour and prenatal exposure, and the adverse effects can be manifested during all stages of their development. Chronic exposure has been linked to childhood cancers (leukaemia, brain tumours); poor motor skills, delayed reflexes, poor memory and other neurodevelopmental issues; asthma, obesity and an increase in non-communicable diseases; stillbirths, miscarriages, low birthweight and maternal death; and physical abnormalities.

Acute pesticide poisoning usually results in death for young children. Exposure symptoms include memory loss and uncontrolled urination, as well as headaches, vomiting and blurred vision.<sup>30</sup> Diagnosing acute pesticide poisoning can be difficult as the symptoms can be mistaken for other illnesses,<sup>31</sup> and the majority of severe poisonings and deaths occur in developing countries,<sup>32</sup> particularly in rural areas, due to such factors as insufficient diagnostic facilities and lack of appropriate treatment.

**Fetal death and birth defects:** Paternal and maternal exposure to pesticides, whether occupational or residential, has been linked to stillbirths,<sup>33</sup> an increased risk of fetal death,<sup>34</sup> and an elevated risk of spontaneous abortion. The most common birth defects include mouth and face clefts, limb defects and neural tube defects, which are generally the defects studied in relationship to pesticide exposure.<sup>35</sup>

**Cancer:** According to the US President's Cancer Panel annual report published in 2010, *"Children of all ages are considerably more vulnerable than adults to increased cancer risk and other adverse effects from virtually all harmful environmental exposures. In addition, some toxics have adverse effects not only on those exposed directly (including in utero), but on the offspring of exposed individuals."*<sup>36</sup> Chronic low-level exposure to indoor insecticides has been linked to childhood hematopoietic cancers,<sup>37</sup> for example, and parental exposure to pesticides has been identified as a potential cause of increased chances of brain tumours in children.<sup>38</sup>

**Neurodevelopment:** Developmental delays of up to two years have been found in children whose mothers had occupational contact with pesticides, exhibiting deficits in motor speed, coordination and visual memory. When children have been exposed to chlorpyrifos (an organophosphate) in the womb, they are more likely to have higher rates of attention deficit hyperactivity disorder at age 3 and lower full-scale IQs and working memory through age 7.<sup>39</sup> Among young children, even low levels of pesticide exposure can affect their neurological and behavioural development.<sup>40</sup> School-age children who had been hospitalized during infancy as a result of acute exposure to organophosphate pesticide were found to have impaired cognitive abilities compared with children in the control groups.<sup>41</sup>

**Endocrine-system disruption:** While nearly 800 chemicals are known to or suspected to have the capacity to interfere with hormone receptors, synthesis or conversion, the vast majority of chemicals in commercial use have not been tested.<sup>42</sup> Many child health issues can be linked to endocrine system disruption prenatally or during crucial stages of development.<sup>43</sup> But the effects may not be apparent until adulthood, making it difficult to establish whether the source of illness is associated with pesticides.<sup>44</sup>



## Preventing children's exposure: Recommendations for action

As described by the Special Rapporteur mandated with examining the human rights aspects of illicitly dumped toxic and dangerous products, *"All around the world, children are born with dozens, perhaps hundreds, of hazardous substances in their bodies. This is leading to what doctors are referring to as a 'silent pandemic' of disease and disability affecting millions during childhood and later in life. ... Prevention of exposure is the best remedy."*<sup>45</sup> This section of the discussion paper touches on five fundamental ways to support preventive measures for children.

### Apply the precautionary principle

The precautionary principle to risk management "denotes a duty to prevent harm, when it is within our power to do so, even when all the evidence is not in."<sup>46</sup> This means that if an action or policy is suspected of causing harm to the population or the environment, the responsible course is to avoid that risk until it has been disproved. This principle can be used by policymakers

making difficult decisions, and is particularly applicable in the case of children and pesticide exposure due to the large variables in scientific data.<sup>47</sup> Strong arguments have also been made for applying the precautionary principle in the case of pesticides due to the limitations of methods such as cost/benefit analysis, and the fact that the true environmental and health costs may not be taken into account by government and business.<sup>48</sup>

### Reducing pesticides is possible without reducing yields

The United Nations Food and Agriculture Organization (FAO) defines integrated pest management as "the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment."<sup>49</sup> Integrated pest management seeks to



Companies can take action by assessing and being aware of their impact, applying the precautionary principle to risk management, and reducing pesticide use without reducing crop yields.

manage pests, rather than eradicate them, and is founded on the idea that the best defence against pests and diseases in agriculture is a healthy agro-ecosystem. Its techniques are often promoted through Farmer Field Schools, in which farmers share field observations and exchange experiences.<sup>50</sup> In this type of training, however, little attention has been given to children and the effects of pesticides, and increasing awareness of this issue is vital.

One of the effective ways to reduce pesticide use is through agro-ecology, which considers the social aspects of building sustainable and fair food systems, as well as the interactions between plants, animals, humans and the environment. Applied agro-ecology seeks local solutions, with links to local economies and markets, and can be leveraged to build resilience to climate change among communities. An enabling policy environment is required to realize the full benefits of this approach, which can be supported through revised government policies, public investments and research priorities.<sup>51</sup> The use of effective agro-ecology practices can have many direct benefits for children, including significantly reduced exposure to pesticides for those who live near agricultural areas.<sup>52</sup>

### **Strengthen core business policies**

Across the globe, companies are taking action to deliver on their responsibility and opportunity to ensure children are not harmed by pesticides used in their supply chains. Many pesticide producers, for example, are requiring that pesticide containers feature pictures, symbols

and easy-to-read information about health and safety. Some manufacturers and distributors are choosing not to engage in aggressive advertising campaigns that are misleading about the effects of pesticides, and others are mandating and providing protective gear for workers handling pesticides directly.

Companies can also take action by assessing and being aware of their impact, applying the precautionary principle to risk management, and reducing pesticides without reducing yields, as touched upon in the previous sections.

Effectively working towards systemic change requires that companies establish explicit core business policies protecting children from highly hazardous pesticides. These policies should be tangible, communicated, enforced and monitored throughout the supply chain. For example, manufacturers' and distributors' policies should make sure that pesticides produced in one country are not exported to countries where they are banned. Other guidance for establishing or revising corporate policies, and implementing them effectively, can be found in the International Code of Conduct on Pesticide Management and the conventions described in the section below, on developing national legislation.

Monitoring compliance and evaluating the effectiveness of core business policies to protect children from the impacts of pesticides will strengthen the identification of best practices. Tested practices can be advocated for and applied at the industry level to support

the development of norms and standards that systemically protect children and address the impacts of pesticides on their health, education and well-being. In addition, business actors can promote positive engagement with government, civil society and communities.<sup>53</sup>

### Develop robust national legislation

Governments often struggle<sup>54</sup> to find the responsible balance between using pesticides where necessary, and reducing adverse health and environmental risks. Though this can be a challenging process, multiple options are available, including legislation to ban or restrict pesticide use; the development of national action plans; and budget allocations to enforce legislation, monitor residues in food and drinking water, and research the side effects of pesticides use.<sup>55</sup> Guidance on national legislation for pesticide use can be found in international conventions and frameworks such as the Rotterdam Convention,<sup>56</sup> the Stockholm Convention<sup>57</sup> and the Strategic Approach to International Chemicals Management.<sup>58</sup>

A key resource, the fourth version of the International Code of Conduct on Pesticide Management, was released in 2014. This document “provides a framework that guides government regulators, the private sector, civil society and other stakeholders on best practice in managing pesticides throughout their lifecycle. Its overall structure remains unchanged and covers every aspect of pesticide management from production to disposal.”<sup>59</sup> The International Code – which is supported

by key pesticide industry associations – is designed to be used in national legislation, complemented with a focus on multisector, shared responsibility and the need for stronger capacities to implement its standards.<sup>60</sup>

There are many ways that government legislation can consider children’s specific vulnerabilities and reduce the risk that they will be harmed by pesticides. Some of these include:

**Ban highly hazardous pesticides:** As a starting point, all countries should ban the pesticides that are known to be highly hazardous, as delineated in the Stockholm Convention on Persistent Organic Pollutants. Countries can apply best practices for all types of pesticides in line with the International Code of Conduct on Pesticide Management and other international guidance.

**Require childproof containers and local-language labelling of containers:** Many pesticide poisonings occur due to children’s hand-to-mouth behaviour. In other cases, children come in contact with pesticides when empty containers are reused for drinking or bathing. Childproofing and clearly labelling containers is a crucial child-specific measure to reduce accidental ingestion or contact with pesticides that will also benefit adults. **Remove obsolete and illicit pesticides:** When obsolete and illicit pesticides are located in public locations or close to living quarters, clean-up is vital, along with action to inform communities of the dangers. Child-friendly, local-language messaging is necessary in all areas where pesticides are dumped or stored.

**Prohibit aerial spraying:** Despite public outcry, aerial spraying of pesticides is allowed in most countries. This method of pesticide application is highly dangerous for communities, especially children and pregnant women, and should be reduced and eliminated. If fields have been sprayed, it is essential to quickly disseminate messaging in the area, with clearly visible warnings for children and pregnant women to keep away from the area, and training for the entire community to understand the meaning of words and symbols on posted signs.

**Implement a national poisoning programme:** Many children and adults do not have adequate care when poisoned by pesticides. Pesticide-related illnesses are often mistaken for other issues and go untreated and unchecked. In particular, a national programme can reduce deaths due to pesticide poisoning among young children.

**Improve risk assessment:** While many national risk assessments relate to the technical viability of a product, few account for protecting women and children. Remedying this calls for a more holistic approach to risk assessment.

**Establish explicit labour policies:** Children and women are working directly with pesticides, either spraying the fields or entering agricultural areas that have been freshly sprayed. During pregnancy, appropriate alternative employment should be found for women who work in these dangerous zones. All agricultural labourers should always be provided with adequate equipment and

Ensuring that children's best interests are protected will require additional research, modifications to core business policies, robust government legislation, and continued monitoring and evaluation

protective clothing when working with pesticides or entering pesticide-treated areas.

This is by no means an exhaustive list, but seeks to meet the paper's aim of highlighting key issues and providing a basis for discussion towards additional systemic actions that protect children from the many impacts of pesticides.

### **Build evidence and awareness**

All stakeholders can contribute to research on specific pesticides, the paths they travel to contaminate children, and their effects on children – from health to safety and education. In regard to these effects, up-to-date data are sorely lacking. Though some studies have addressed adult pesticide exposure in the workforce, there is very little research that examines the health outcomes for adolescents or children working with pesticides.<sup>61</sup>

The need to evaluate this is urgent – and accurate evaluation depends on consistent, comprehensive and targeted data, gathered and shared by government, health systems, international organizations and academic institutions.

In addition, through expanded public research on agro-ecological farming, we can gain knowledge and identify solutions that address:

- Children's special vulnerability to pesticides, including adverse health and developmental effects;
- Severe risks to children when mothers work directly with pesticides, including exposure in utero due to placental transmission and during infancy through contaminated breast milk;
- Hazardous labour conditions for children in agricultural supply chains and the impact on their health, education and well-being;
- Unsafe use, application and disposal of illegal and hazardous pesticides;
- Environmental pathways of exposure – soil, water, air – affecting children; and
- Farmers' perceptions of pesticides and how advanced education may prompt better practices.

The purpose of this paper is to raise awareness about the various pathways of exposure and associated impacts of pesticide use on children. It is our hope that this information will serve as a foundation for discussion about systemic actions that sustainably address children's rights. Achieving this aspiration will require additional research, modifications to core business policies, robust government legislation, and continued monitoring and evaluation to ensure that efforts are delivering as intended, in the best interests of children.



# Annex I:

## Defining and classifying pesticides

### What are pesticides?

The FAO-WHO definition of 'pesticides' is *"any substance, or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth."*<sup>62</sup> This includes materials that modify pest behaviour or physiology (insect repellents, synergists) or affect crops during production or storage (herbicide safeners, germination inhibitors), as well as insecticides, fungicides and herbicides.

Pesticides can be naturally derived or synthetically produced, and are used mainly in agriculture but also in commercial, domestic, urban and rural environments. Pesticide products contain both 'active' and 'inert' ingredients. An active ingredient prevents, destroys, repels or mitigates a pest, or is a plant regulator, defoliant, desiccant or nitrogen stabilizer.<sup>63</sup> All other ingredients are considered to be inert, and are often added to enhance performance and usability. Both types of pesticide ingredients can be harmful to humans if misused.

Types of pesticides and their intended functions

Type	Function
Herbicide	Destroy and prevent the spread of weeds or unwanted vegetation; some commonly used herbicides are paraquat, glyphosate and propanil
Fungicide	Control, destroy, make harmless or regulate the effect of a fungus
Rodenticide	Used specifically for controlling rodents such as mice and rats
Insecticide	Destroy, suppress, stupefy, inhibit the feeding of, or prevent infestations or attacks by an insect; some commonly used insecticides are organochlorines, organophosphates and carbamates
Bactericide/disinfectant	Destroy, suppress or prevent the spread of bacteria

**Source:** World Health Organization, Children's Health and the Environment: WHO Training Package for the Health Sector, July 2008, open PDF from <[www.who.int/ceh/capacity/Pesticides.pdf](http://www.who.int/ceh/capacity/Pesticides.pdf)>.

**Classification of hazards:** The WHO classification system, first developed in 1975 and since revised many times, is designed to assess the toxicity of various forms of pesticides. While the classification of many of pesticides are only for acute risks to health, evaluations of other effects, including cancer, have been completed for many compounds. Many pesticides still used in the developing world are considered to be 'extremely' to 'moderately' hazardous due to poor regulation and incorrect use of pesticides by farmers. Exposure/hazard levels for children are not specifically considered when these pesticide hazards are classified, as they are most commonly directed towards adults.

For details on the WHO criteria, see:  
The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009, p. 5. Available at 'International Programme on Chemical Safety', <[www.who.int/ipcs/publications/pesticides\\_hazard/en](http://www.who.int/ipcs/publications/pesticides_hazard/en)>.

**Insecticides and herbicides:** Insecticides are chemicals used to control insects by killing them or preventing them from engaging in behaviours deemed undesirable or destructive. They are classified based on their structure and mode of action. Many insecticides act upon the nervous system of the insect, while others act as growth regulators or endotoxins. Insecticides are commonly used in agricultural, public health and industrial applications, and in household and commercial uses, e.g., control of roaches and termites. The most commonly used insecticides are organophosphates, pyrethroids and carbamates.

Herbicides are chemicals used to manipulate or control undesirable vegetation. Herbicides can act by inhibiting cell division, photosynthesis or amino acid production, or by mimicking natural auxin hormones, which regulate plant growth, and causing deformities in new growth. The potential effects of herbicides are strongly influenced by their toxic mode of action and their method of application. Methods of application include spraying onto foliage, applying to soils and applying directly to aquatic systems.

Understanding the modes of action for insecticides and herbicides can aid in the identification of a candidate cause, particularly when enzyme assays or similar tests are used in symptom identification of affected organisms.

For details on the modes of action for insecticides and herbicides, see:

United States Environmental Protection Agency, 'Table 1. Insecticide Types and Their Modes of Action', CADDIS Volume 2. Sources, Stressors and Responses: Insecticides, Updated 12 September 2017, <[www.epa.gov/caddis-vol2/caddis-volume-2-sources-stressors-and-responses-insecticides](http://www.epa.gov/caddis-vol2/caddis-volume-2-sources-stressors-and-responses-insecticides)>;  
and 'Table 1. Common Applications and Modes of Action of the Ten Most Heavily Used Herbicides in the United States', 2001, CADDIS Volume 2. Sources, Stressors and Responses: Herbicides, Updated 12 September 2017, <[www.epa.gov/caddis-vol2/caddis-volume-2-sources-stressors-and-responses-herbicides](http://www.epa.gov/caddis-vol2/caddis-volume-2-sources-stressors-and-responses-herbicides)>

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## ANNEX II: Children, Pesticides And The SDGs

Many of the Sustainable Development Goals (SDGs) are closely interlinked with the issues related to the effect of pesticides on children's health and well-being. In order to advance the SDGs, these issues must be addressed as listed below:

SDG	Targets	Indicators	Pesticides relationship
<b>3. Ensure healthy lives and promote well-being for all at all ages</b>	<b>3.2</b> By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	<b>3.2.1</b> Under-five mortality rate <b>3.2.2</b> Neonatal mortality rate	Addressing the harmful impacts of pesticides on women and children will reduce the rate of deaths caused by them
	<b>3.4</b> By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	<b>3.4.1</b> Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease. <b>3.4.2</b> Suicide mortality rate	Pesticide misuse over the long term can lead to chronic diseases mentioned in this indicator  Pesticides are commonly used as a medium for suicide in rural communities
	<b>3.9</b> By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	<b>3.9.1</b> Mortality rate attributed to household and ambient air pollution <b>3.9.2</b> Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH services) <b>3.9.3</b> Mortality rate attributed to unintentional poisoning	Pesticides are commonly kept in the household and thus contribute to household pollution  Pesticides contaminate water sources and household water supplies
<b>6. Ensure access to water and sanitation for all</b>	<b>6.3</b> By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	<b>6.3.2</b> Proportion of bodies of water with good ambient water quality	Pesticide misuse, and poor management leads to contaminated water sources  Similarly, pesticides that are persistent in the environment end up in water sources
<b>8. Promote inclusive and sustainable economic growth, employment and decent work for all</b>	<b>8.4</b> Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead	<b>8.4.2</b> Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP	Pesticide contact in women and children results from employment in food production through agriculture  Sustainable and efficient food production requires safe use and handling practices of potentially harmful chemicals
	<b>8.8</b> Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	<b>8.8.1</b> Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status	In rural agricultural communities, some children work within the family farm to help make a living wage  Pesticide misuse has led to chronic disease and death and thus constitutes occupational injury and death
<b>12. Ensure sustainable consumption and production patterns</b>	<b>12.4</b> By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	<b>12.4.1</b> Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement	Addressing pesticide best practices in rural agricultural communities will be a significant part of addressing this goal  Businesses also must create responsible products
	<b>12.A</b> Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	<b>12.A.1</b> Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies	Support from developed countries that have strong pesticide regulations and practices will help achieve the goal of responsible food production

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