



---

# **PAN International List of Highly Hazardous Pesticides**

**(PAN List of HHPs)**

March 2019



## **Impressum**

© PAN International

c/o PAN Germany, Nernstweg 32, 22765 Hamburg, Germany

March, 2019

This 'PAN International List of Highly Hazardous Pesticides' was initially drafted by PAN Germany for PAN International. The 1<sup>st</sup> version was published January 2009. Since then criteria had been revised and the list has been updated several times as classifications changed for numerous individual pesticides.



# Contents

Background and introduction .....	4
About this List.....	8
What is new in this List .....	10
Work in progress .....	11
PAN International Indicators for Identifying ‘Highly Hazardous Pesticides’ .....	12
Explanatory notes and comments regarding the classification systems, lists and indicators being used by PAN to identify Highly Hazardous Pesticides.....	13
Method applied to identify highly hazardous pesticides .....	18
Evolution of the PAN List of Highly Hazardous Pesticides .....	18
Explanatory notes regarding the table of active ingredients.....	21
The table of active ingredients.....	22

## Background and introduction

For decades, the distribution and use of hazardous pesticides has been an issue of concern. Since its founding in 1982, Pesticide Action Network (PAN) has been the civil society organization most steadily and continuously calling for effective international action on the elimination of hazardous pesticides. PAN has been one of the key driving forces among non-governmental organisations (NGOs) for improving pesticide and crop protection policies towards safer, socially just, environmentally sustainable and economically viable pest management systems.

### 1980s: the first international Code of Conduct on pesticides

In 1985 the *International Code of Conduct on the Distribution and Use of Pesticides* was adopted by the United Nations Food and Agriculture Organization (FAO) to respond to the growing evidence of risks and harm associated with the use of pesticides. The first version of the 'Code of Conduct' already indirectly questioned the effectiveness of the 'safe use of pesticides' concept as an overall approach to solving pesticide related problems – the Code Article 5.2.3 stated that “*industry should halt sale and recall products when handling or use pose an unacceptable risk under any use directions or restrictions*”. Since the 1980s a number of international instruments and guidelines have been adopted<sup>1</sup> to tackle pesticide related problems. Additionally, many public and private initiatives have been implemented to reduce the adverse effects of pesticide use in agriculture. However, in general, these initiatives have been successful only to a limited extent and the 'safe use' training approach to highly hazardous pesticides has been questioned increasingly by NGOs, scientists, governmental representatives, UN agencies and the private sector.

### 2000s: a new paradigm emerges on reducing hazards, as well as risks

Meanwhile numerous initiatives in food, forestry and flower production and distribution chains have developed their own prohibited or restricted lists for specific pesticides. In November 2009, the European Union abandoned its former paradigm based on assessment of pesticide *risks* only, with its new pesticide authorisation Regulation 1107/2009/EC,<sup>2</sup> which emphasises the need to take intrinsic *hazards* into account. Accordingly, Reg. 1107/2009 stipulates that pesticide substances (active ingredients) proven to be carcinogenic, mutagenic, toxic for reproduction and endocrine disruptors shall *not* be authorised in the EU.

In 2006, the Strategic Approach to International Chemicals Management (SAICM) was adopted. This voluntary agreement, under the auspices of the United Nation Environmental Programme (UNEP), recognised the need for action to reduce dependency on pesticides worldwide, including phasing out highly toxic pesticides and promoting safer alternatives. In November 2006, the FAO Council discussed and endorsed SAICM. In view of the broad range of activities envisaged within SAICM, the Council suggested that the activities of FAO

---

<sup>1</sup> E.g. the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (<http://www.pic.int>), the Stockholm Convention on Persistent Organic Pollutants (<http://www.pops.int>) and the Strategic Approach to International Chemicals Management (<http://www.saicm.org>)

<sup>2</sup> EC (2009): Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. Official Journal of the European Union L 309. 24.11.2009

could include **risk reduction, including the progressive ban on highly hazardous pesticides**, promoting good agricultural practices, ensuring environmentally sound disposal of stock-piles of obsolete pesticides and capacity-building in establishing national and regional laboratories. The term 'progressive ban' refers to national or regional regulatory banning over time of different pesticides identified as highly hazardous, and/or voluntary step-by-step phase out of their use by individual food and fibre companies, private standards or others.

In April 2007, the FAO Council informed the Committee on Agriculture (COAG)<sup>3</sup> of its intention to develop a new initiative for pesticide risk reduction. COAG welcomed the initiative to reduce risks associated with the use of hazardous pesticides, including the progressive ban on highly hazardous pesticides.<sup>4</sup>

### **2007: FAO and WHO launch the Highly Hazardous Pesticide initiative**

In October 2007, the FAO/WHO Joint Meeting on Pesticide Management (JMPM) discussed the so-called thought starter paper “*Addressing Highly Toxic Pesticides (HTPs)*” with a note from the Secretariat explaining: “*Through this thought-starter FAO wishes to start its work on highly hazardous pesticides.*” (...) “*This thought-starter builds on the information document provided to COAG on pesticide risk reduction. As a first step, this paper focuses on options for defining highly hazardous pesticides.*” Based on this thought starter the JMPM outlined criteria to identify highly hazardous pesticides (HHPs). In addition, the JMPM “*recommended that FAO and WHO, as a first step, should prepare a list of HHPs based on the criteria identified, and update it periodically in cooperation with UNEP. It further requested that such a list should be made widely known to all stakeholders involved in pesticide regulation and management.*”<sup>5</sup>

Also in 2007 the JMPM developed the following criteria for highly hazardous pesticides:

- Pesticide formulations that meet the criteria of classes Ia or Ib of the WHO Recommended Classification of Pesticides by Hazard; or
- Pesticide active ingredients and their formulations that meet the criteria of carcinogenicity Categories 1A and 1B of the Globally Harmonized System on Classification and Labelling of Chemicals (GHS); or
- Pesticide active ingredients and their formulations that meet the criteria of mutagenicity Categories 1A and 1B of the Globally Harmonized System on Classification and Labelling of Chemicals (GHS); or
- Pesticide active ingredients and their formulations that meet the criteria of reproductive toxicity Categories 1A and 1B of the Globally Harmonized System on Classification and Labelling of Chemicals (GHS); or
- Pesticide active ingredients listed by the Stockholm Convention in its Annexes A and B, and those meeting all the criteria in paragraph 1 of Annex D of the Convention; or

---

<sup>3</sup> The FAO Committee on Agriculture (COAG) conducts periodic reviews and appraisals of agricultural and nutritional problems in order to propose concerted action by Member Nations and the Organization. It also reviews the agriculture and food and nutrition work programmes of the Organization and their implementation, with emphasis on the integration of all social, technical, economic, institutional and structural aspects in promoting agricultural and rural development. Its functions are enumerated in Rule XXXII of the General Rules of the Organization. Membership must be renewed formally each biennium

<sup>4</sup> The Report of the Twentieth Session of the Committee on Agriculture (Rome, 25-28 April 2007), CL 132/9, is available at: [http://www.fao.org/unfao/bodies/coag/coag20/index\\_en.htm](http://www.fao.org/unfao/bodies/coag/coag20/index_en.htm)

<sup>5</sup> The minutes of the panel of experts meeting October 2007 are available at: <http://www.fao.org/agriculture/crops/core-themes/theme/pests/code/panelcode/en/>

- Pesticide active ingredients and formulations listed by the Rotterdam Convention in its Annex III; or
- Pesticides listed under the Montreal Protocol; or
- Pesticide active ingredients and formulations that have shown a high incidence of severe or irreversible adverse effects on human health or the environment.<sup>6</sup>

### **2009: PAN International publishes its first PAN List of HHPs**

PAN International strongly welcomed the decisions made by the FAO Council, the COAG and the JMPM. PAN was of the opinion, however, that the list of HHP criteria agreed by the JMPM had some important shortcomings: in particular, it is important to note that pesticides with endocrine disrupting properties, eco-toxicological properties, or inhalation toxicity have *not* been taken into account by the JMPM.

Because of these shortcomings, PAN International decided to independently build on the JMPM criteria for HHPs to develop a more comprehensive set of hazard criteria, used by recognised authorities, such as the EU and the US Environmental Protection Agency (EPA), and to develop a list of HHP pesticide active ingredients based on these selected criteria.

Meanwhile, international pressure to curb the use of HHPs has continued to increase. In September 2012, at the third International Conference on Chemicals Management in Nairobi, over 60 countries and other participating organizations called for the Conference to support the development of a list of HHPs, a progressive ban of HHPs, and their substitution with safer alternatives. No decision was taken as the item was not on the formal agenda; however, intercessional regional SAICM meetings discussed proposals for action on highly hazardous pesticides leading up to the Open-Ended Working Group in late 2014 and the fourth International Conference on Chemicals Management in 2015.<sup>7</sup>

### **2013-2016: Stakeholder action grows on addressing HHPs**

In 2013, the updated and renamed *International Code of Conduct on Pesticide Management* was released. It was originally intended to contain an annex with the JMPM criteria for HHPs. However, it was decided instead to develop a separate guidance document: ‘Guidelines on Highly Hazardous Pesticides’. The purpose of the guidance document is to provide a framework and practical methods for identifying HHPs, along with methods for their control. The definition of HHPs in the new Code of Conduct on Pesticide Management (adopted by FAO and WHO in 2013) and in the Guidelines on Highly Hazardous Pesticides, adopted in 2016<sup>8</sup>) is:

*“Highly Hazardous Pesticides means pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as WHO or GHS or their listing in relevant binding international agreements or conventions. In addition, pesticides that*

---

<sup>6</sup> The minutes of the panel of experts meeting October 2007 are available at:

<http://www.fao.org/agriculture/crops/core-themes/theme/pests/code/panelcode/en/>

<sup>7</sup> PAN and IPEN (2013): Thought starter paper on Highly Hazardous Pesticides and the Strategic Approach to International Chemicals Management submitted by PAN and IPEN. SAICM/RM/LAC.4/INF/9. 4th Latin American and Caribbean regional meeting on the Strategic Approach to International Chemicals Management (SAICM) and related consultations, Mexico City, 19 to 22 August 2013

<sup>8</sup> FAO and WHO (2016): International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous Pesticides, Rome 2016 <http://www.fao.org/publications/card/en/c/a5347a39-c961-41bf-86a4-975cdf2fd063/>

*appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous.”*

The Code also contains a definition of the term ‘hazard’:

*“Hazard means the inherent property of a substance, agent or situation having the potential to cause undesirable consequences (e.g. properties that can cause adverse effects or damage to health, the environment or property).”*

### **The Present**

To implement a progressive ban of HHPs as supported by the FAO Council, the COAG, the JMPM and others, all stakeholders mentioned in the International Code of Conduct on the Distribution and Use of Pesticides should develop plans of action for a progressive ban of HHPs. These stakeholders include governments, the pesticide industry, the food industry, farmers and farmer organizations and public interest groups.

This active stakeholder participation is especially important as there are currently no legal instruments available to achieve a structured and clearly targeted global progressive ban of HHPs other than the Stockholm Convention for Persistent Organic Pollutants (POPs), which focuses only on a very small group of HHPs.

The PAN International List of HHPs provides a basis for action to implement the progressive ban of highly hazardous pesticides and replace them with safer, agro-ecological and other appropriate non-chemical alternatives. PAN would like to encourage individuals, institutions, organizations and companies to develop a plan of action with priorities, timeframes and concrete measures. PAN itself will support such initiatives wherever possible.

*Susan Haffmans, PAN Germany, on behalf of the PAN International Regional Centers*  
*PAN Africa*  
*PAN Asia and the Pacific*  
*PAN Europe (PAN Germany and PAN UK)*  
*PAN Latin America*  
*PAN North America*

# About this List

## History

The *PAN International List of Highly Hazardous Pesticides* was initially developed by PAN Germany for PAN International to answer the question "What are highly hazardous pesticides?" The first version of this HHP List was published January 16th, 2009. In 2013/2014 PAN International reviewed the hazard criteria used in this list and changes were agreed in 2014. These relevant changes had been explained in the section '*What is new in this list?*' in the 2015 PAN International HHP List. In 2018 the criteria regarding the Rotterdam Convention were extended. No changes of criteria have been carried out since.

## Purpose

This publication describes how PAN International defines Highly Hazardous Pesticides (HHPs) by identifying the hazard criterion indicators. An explanation of the different hazard criteria selected is followed by a list of HHPs generated on the basis of these criteria. The PAN International HHP List serves as a list of pesticides to be progressively banned. All stakeholder groups can use it as a decision tool for their pesticide policies, such as developing prohibited or restricted lists in private standards or to prioritise actions for reducing pesticide hazards and risks in a specific country.

## Focus and scope

The PAN HHP list contains active ingredients intended to destroy, deter, render harmless, prevent the action of, or otherwise exert a controlling effect on any harmful or annoying organism, or manage vegetative growth, except for those used as disinfectants, or internal human or veterinary medicines. It includes: pesticides used in agriculture, forestry, fisheries, vector control, homes, other buildings, and transport; those used for control of ectoparasites (e.g. ticks on livestock); rodenticides and other vertebrate poisons; wood preservatives; plant growth regulators; fumigants; and those incorporated into materials and other products. It excludes: synergists, safeners, adjuvants and other additives in formulated pesticide products; and all the break-down products (metabolites) of pesticide active ingredients. It also contains some specific pesticide formulations, which have been recognized by relevant international conventions (see footnotes below the HHP-table at the end of this document).

## Basis

The PAN HHP list is currently based only on classifications by recognised authorities. It is created by compiling information from WHO, US EPA, the EU Commission and the Pesticide Property Database.

In future, the HHP List will also be based on recorded cases of pesticide active ingredients and formulations that have shown a **high incidence of severe or irreversible adverse effects** on human health or the environment, when robust, evidence-based and publicly accessible data becomes available.

.....

## Structure

The hazard criteria are grouped into:

- acute toxicity
- long term (chronic) health effects
- environmental hazard criteria
- international regulations (global pesticide-related conventions)

## Limitations

It is important to note that the list of HHPs presented in this publication is *still not complete*. There are several reasons for these limitations:

- One major reason is that the criteria used for the PAN definition of HHPs are based on widely accepted classifications. Due to the time needed for achieving consensus on ‘individual pesticides’ class or category these classifications do have shortcomings, as explained in this publication.
- Another reason is that science research shows a number of so-called “emerging properties” about new or poorly understood side effects, e.g. pesticides with endocrine disrupting properties. Such properties and appropriate definitions, hazard classifications and threshold values are not sufficiently operationalised for pesticides as yet.
- Measures to identify substances of high environmental concern are currently restricted to selected criteria which do not reflect the overall environmental concerns.
- In addition, pesticides that may be shown to be linked with a high incidence of severe or irreversible adverse effects on human health or the environment are not identified systematically yet. Based on ongoing community monitoring of pesticide impacts and scientific literature research, PAN will identify and list such highly hazardous pesticides in the future.
- Experiences in the past show that pesticides classified as only “moderately hazardous” by the World Health Organization (WHO Class II) nevertheless give valid reason for concern. Examples are endosulfan and paraquat, pesticides that have caused thousands of poisonings, especially in developing countries, or pyrethroids which are known to cause various ill health incidences in the US. However, with a view to prioritisation, PAN decided not to add WHO II (“moderately hazardous”) pesticides to the list of hazard criteria for acute toxicity.
- Contamination with dioxin: in the context of the Stockholm Convention, the Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs (January 2013), identified a number of pesticides that can be contaminated with the highly toxic by-product dioxin during the production process and remain in the final product; these pesticides include 2,4-D, chlornitrofen or 2,4,6-trichlorophenyl-4-nitrophenylether (CNP), pentachlorophenol (PCP), and sodium pentachlorophenol (PCP-Na). This is a hazard feature the list is not considering currently.
- Pesticides classified as obsolete pesticides by FAO and WHO are not included in the list. Accordingly, the 2013 update of the PAN HHP List removed several pesticides now classified as obsolete by FAO. However, we know that limited uses still happen illegally, especially if obsolete stockpiles remain and that those pesticides cause harm still today.

## What is new in this List

This February 2019 version serves as an annual update triggered by new evaluations. No changes regarding the set of criteria for identifying HHPs have been made since the last update in 2018. Compared to the previous version of the HHP list (Version March 2018) the following changes occurred:

### Four pesticides have been deleted:

1. Cyflufenamid, sedaxane, Sodium dimethyl dithiocarbamate and nitrapyrin are removed from the list as they are no longer classified as “probable carcinogen to humans” by US EPA Annual Cancer Report

### Nine pesticides have been added:

1. Cyproconazole – for being classified as presumed human reproductive toxicant according to EU GHS
2. Propiconazole – for being classified as presumed human reproductive toxicant according to EU GHS
3. Tioxafen – for being classified as probable carcinogen by US EPA Annual Cancer Report
4. Propineb – for being classified as probable carcinogen by US EPA Annual Cancer Report
5. Flupyradifurone – for being highly toxic to honey bees (oral LD50)
6. Noviflumuron – for being classified as probable carcinogen by US EPA Annual Cancer Report
7. Calcium cyanide - for being classified as WHO Ia
8. Sodium cyanide -for being classified as WHO Ib and
9. Hydrogen cyanide – for being classified as ‘Fatal if inhaled’ (H330) according to the EU GHS.

### A new group “Glyphosate and its salts” was added

Instead of referring to the single entry for glyphosate (acid), a new group “glyphosate and its salts” was added and the single entry for glyphosate (acid) deleted. With this change we follow the International Agency for Research on Cancer (IARC) which listed in its Glyphosate-Monograph<sup>9</sup> a group “Glyphosate and its salts” consisting of the following six active ingredients: glyphosate (acid), glyphosate-diammonium, glyphosate-isopropylamine (also known as glyphosate--isopropylammonium;- IPA), glyphosate-monoammonium, glyphosate-sodium, and glyphosate-trimesium (see table of grouped pesticides)

### Three pesticides already in the HHP List have qualifying criteria changed:

1. Quizalofop-p-tefuryl – is now classified as endocrine disruptor (EDC) for being classified as “Suspected human reproductive toxicant’ (Category 2) *AND* “Suspected human carcinogen” (Category 2) according to EU GHS. The “Repr. 1B” according to EU GHS does not apply anymore

---

<sup>9</sup> IARC (2015) Monograph on Glyphosate <https://monographs.iarc.fr/wp-content/uploads/2018/06/mono112-10.pdf>

2. Spirodiclofen was already classified a probable carcinogenic by the US EPA and is now also classified as “Carc 1B” by the EU GHS
3. Metaflumizone is very persistent in the water-sediment environment and the Bioconcentration factor is over 5000. It is therefore additionally classified as P = Persistent and B = Bioaccumulative
4. Lindane was already classified in several categories and in 2018 IARC classified it as “Carcinogenic to humans”.

## Work in progress

The FAO definition of a HHP includes **pesticides linked with a high incidence of severe or irreversible adverse effects on human health or the environment**. However, such pesticides are not yet systematically identified via a single, globally recognised assessment or classification process (as mentioned above under limitations).

PAN International is working on indicators, threshold values and reliable and consistent data sources to identify pesticides causing irreversible adverse effects on **humans**. PAN International already agrees on suitable criteria for intentional and occupational or accidental poisoning: the Poisoning Severity Score (PSS) and/or the case fatality rate (CFR).<sup>10</sup>

However, setting the threshold value for what level or scale of poisoning incidence should qualify as an HHP is a subjective question, based on personal judgement of the ethical aspects, for which PAN has not yet developed an agreed position. It was therefore decided to start by collecting available, robust and well-documented data and then to discuss appropriate threshold values.

Another area of work is to look at environmental hazard criteria for other ecosystem services, beyond pollination. Especially relevant for pesticide policy is the service of natural pest control provided by a range of beneficial organisms (natural enemies of insect pests, crop diseases and weeds). These beneficial organisms are of such major agro-ecological (and economic) importance that pesticides severely interfering with their ‘services’ should not be used. However, a robust or comprehensive classification which could be used for this natural pest control criterion is not yet available. PAN International plans to work on this issue and invites scientists who are interested in supporting the development of such a criterion to contribute their suggestions and expert advice.

## Feedback welcome!

PAN International warmly welcomes constructive feedback from any stakeholders involved in pesticide risk management or policy on this updated and revised version of the PAN HHP List. In particular, we are keen to learn how the List is being used in decision-making in public or private sector organisations, along with any suggestions of how it could be improved in the next version or disseminated more widely.

**Please send your feedback to:**

susan.haffmans@pan-germany.org

---

<sup>10</sup> [www.who.int/ipcs/poisons/pss.pdf](http://www.who.int/ipcs/poisons/pss.pdf)

# PAN International Indicators for Identifying 'Highly Hazardous Pesticides'

The following Table shows the criteria and sources used by PAN to identify pesticides considered to be highly hazardous according to PAN.

<b>High acute toxicity</b>
'Extremely hazardous' (Class Ia) according to WHO Recommended Classification of Pesticides by Hazard or
'Highly hazardous' (Class Ib) according to WHO Recommended Classification of Pesticides by Hazard or
'Fatal if inhaled' (H330) according to the Globally Harmonized System (GHS) or
<b>Long term toxic effects</b>
Carcinogenic to humans according to IARC, US EPA or 'Known or presumed human carcinogens' (Category I) according to the Globally Harmonized System (GHS) or
Probable/likely carcinogenic to humans according to IARC, US EPA or
'Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans', 'Substances known to induce heritable mutations in the germ cells of humans' (Category I) according to the Globally Harmonized System (GHS) or
'Known or Presumed human reproductive toxicant' (Category I) according to the Globally Harmonized System (GHS) or
<b>Endocrine disruptor</b>
EU interim criteria 'Suspected human reproductive toxicant' (Category 2) <i>AND</i> 'Suspected human carcinogen' (Category 2) according to the Globally Harmonized System (GHS) or
potential endocrine disruptor according to EU Category 1 of the EU priority list (2004) or
<b>High environmental concern</b>
Pesticides listed in Annex A & B of the Stockholm Convention or meeting the Conventions' criteria or Ozone depleting pesticides according to the Montreal Protocol or
<b>High environmental concern – where <u>two</u> of the three following criteria are met:</b>
<b>P</b> = 'Very persistent' half-life > 60 days in marine- or freshwater or half-life > 180 days in soil ('typical' half-life), marine or freshwater sediment) (Indicators and thresholds according to the Stockholm Convention) <i>AND/OR</i>
<b>B</b> = 'Very bioaccumulative' (BCF >5000) or Kow logP > 5 (existing BCF data supersede Kow log P data) (Indicators and thresholds according to the Stockholm Convention) <i>AND/OR</i>
<b>T</b> = Very toxic to aquatic organisms (LC/EC 50 [48h] for Daphnia spp. < 0,1 mg/l)
<b>Hazard to ecosystem services</b>
'Highly toxic for bees' according to U.S. EPA (LD50, µg/bee < 2) or
<b>Known to cause a high incidence of severe or irreversible adverse effects</b>
Pesticides listed in Annex III of the Rotterdam Convention or meeting the Conventions' criteria

# Explanatory notes and comments regarding the classification systems, lists and indicators being used by PAN to identify Highly Hazardous Pesticides

## The Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

The aim of the GHS is a global harmonization of the classification and labelling of chemicals. The Plan of Implementation of the World Summit on Sustainable Development (WSSD), adopted in Johannesburg in 2002, encourages countries to implement the GHS. It has been adopted by a large number of countries as the main chemical hazard communication system, but it has not yet been fully implemented on a global scale. In this list PAN refers to the EU Regulation 1272/2008/EC on classification, labelling and packaging of substances and mixtures which entered into force in January 2009 and which implements the GHS in the Europe Union. In recent years other governments have also published lists with GHS classifications and further might follow. PAN International will decide on a procedure to address potential deviances. Until then PAN continues using the EU Regulation 1272/2008/EC and its amendments to identify pesticides which are considered highly toxic via inhalation, carcinogenic, mutagenic and/or toxic to reproduction.

### Source used:

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments.

## The WHO Recommended Classification of Pesticides by Hazard

The latest revision of the WHO Recommended Classification of Pesticides by Hazards was conducted in 2009 and contains about 870 pesticides. The PAN HHP list includes those pesticides listed in WHO Class Ia and Ib.

This most recent version of the WHO classification must be considered incomplete for the following reasons:

- The WHO classification for the oral acute toxicity to rats presents in some cases a gross underestimation of the real risk for humans (see Dawson et al. 2010<sup>11</sup>). Pesticides with the highest documented human fatality rates: paraquat dichloride and endosulfan (ibid.) are neither rated 'Extremely hazardous' nor 'Highly hazardous' (i.e. not in Class Ia or Ib).
- Since the last revision a large number of new active ingredients have entered the market, but their hazards have not yet been classified by WHO. Some of these new pesticides may qualify as HHPs.

---

<sup>11</sup> Dawson AH, Eddleston M, Senarathna L, Mohamed F, Gawarammana I, Bowe SJ, Manuweera G, Buckley NA (2010): Acute Human Lethal Toxicity of Agricultural Pesticides: A Prospective Cohort Study. *PLoS Medicine* 7(10): e1000357

- LD<sub>50</sub> values for inhalation toxicity are not included in the WHO classification. This is a major deficiency because users of pesticides are often exposed via inhalation.
- Endocrine disruption is not included in the WHO classification.
- Formulations are not included in the classification. The acute toxicity of formulations and mixtures can be calculated based on the percentage and the LD<sub>50</sub> values of the active ingredients in the formulation or mixture. However, so-called ‘inert’ ingredients or solvents<sup>12</sup> are neglected in this calculation although they may have an influence on the toxicity of the formulation or the mixture.

**Source used:**

WHO (2010): The WHO recommended classification of pesticides by hazard and guidelines to classification 2009, International Program on Chemical Safety (IPCS) & World Health Organization (WHO), Geneva.

**International Agency for Research on Cancer (IARC)**

The International Agency for Research on Cancer (IARC) is part of the World Health Organization (WHO). The goal of IARC is to evaluate, with the assistance of international working groups of experts, critical reviews and evaluations of evidence of carcinogenicity and to publish them in monographs. This series of monographs started in 1972 and since then, almost 900 agents have been reviewed. Participants in the working groups are individual scientists who do not represent organizations, industry or governments.

Only those pesticides which are classified as ‘carcinogenic to humans’ or ‘probably carcinogenic to humans’ have been included in this revised version of the PAN List of HHPs.

**Source used:**

IARC (2018): Agents reviews by the IARC Monographs, Volumes 1-123 (by CAS Numbers), International Agency for Research on Cancer (IARC), Lion, France. Website: <http://monographs.iarc.fr/ENG/Classification/>

**U.S. Environmental Protection Agency (U.S. EPA)**

The U.S. EPA Office of Pesticide Programs maintains a List of Chemicals Evaluated for Carcinogenic Potential<sup>13</sup>. This list is a product of the general risk assessment included in the process of pesticide registration. This classification includes the potential exposure of humans<sup>14</sup>. Therefore, a low exposure potential can place a pesticide in a lower category even when sufficient evidence of carcinogenicity exists. U.S. EPA’s classification of carcinogenicity has changed several times over the last 20 years. The list is updated annually, but its focus is mostly on pesticides registered in the USA.

---

<sup>12</sup> “Inert” ingredients are substances which can enhance the efficiency of the active substance, make a product more degradable or easier to use. ‘Inerts’ are mostly handled as trade secrets of the manufacturer, which means they are not included on the product label.

<sup>13</sup> US EPA (up to 2018): Chemicals Evaluated for Carcinogenic Potential, November 2012, Science Information Management Branch, Health Effects Division, Office of Pesticide Programs U.S. Environmental Protection Agency (US EPA), Washington DC, USA

<sup>14</sup> Altenburger, R., Bödeker, W., Brückmann, S., Oetken, G., Weber, C. (1999): Zur Human- und Ökotoxizität von Pestiziden, die im Bananenanbau verwendet werden, Pestizid Aktions-Netzwerk e.V. (PAN Germany), Hamburg, Germany

**Source used:**

US EPA (up to 2018): Annual Cancer Report. Chemicals Evaluated for Carcinogenic Potential, Science Information Management Branch, Health Effects Division, Office of Pesticide Programs U.S. Environmental Protection Agency (US EPA), Washington DC, USA

**Classification for bee toxicity**

The US EPA also defines categories for environmental toxicity of pesticides<sup>15</sup>. US EPA defines a pesticide as highly toxic to bees if the LD<sub>50</sub> is lower than 2 micrograms per bee (µg/bee). Pesticides highly toxic to bees are included in the PAN List of HHP.

**EU categorisation of endocrine disruptors**

The issue of endocrine disrupting pesticides gained widespread public, political and scientific attention at the beginning of the 1990s. Today there are still no confirmed lists of pesticides with endocrine disrupting properties on any official national or international level (e.g. EU, WHO). However, some years ago, the EU developed a priority list of pesticides with evidence for endocrine disrupting properties (EC 2000, EC 20004 and EC 2007). In the PAN list of HHPs all EU Category 1 pesticides (at least one study providing evidence of endocrine disruption in an intact organism) are included as one of the two used EDC criteria. In 2018 the EU finally adopted a set of criteria and technical guidelines to identify endocrine disruptive pesticides, and analysis will be done on a case-by-case basis. It will take some years to identify which pesticides currently on the market are “endocrine disruptors” (ED) according to this agreed criteria<sup>16</sup>. Until there will be a list of pesticides assessed accordingly, the PAN HHP List will continue to use the EU interim criteria for EDCs as laid down in the Pesticide Regulation 1107/2009/EC. These includes pesticides which meet the CLP classification as carcinogenic category 2 AND toxic for reproduction category 2 (see second criteria for EDC pesticides used by PAN). Knowing that this approach is not satisfactory, we will follow approaches to identify ED pesticides from other regions and agencies and consider integrating them in this List in the future.

Background information: With Regulation 1107/2009/EC the European Union decided to exclude from EU authorization pesticide active ingredients with endocrine disrupting properties that may cause adverse effects in humans or non-target organisms.

Pending the adoption of criteria to identify pesticides with ED properties, the EU agreed on the following interim criteria<sup>17</sup>: Substances that are or have to be classified in accordance with the provisions of Regulation (EC) No 1272/2008 (CLP) as carcinogenic category 2 AND toxic for reproduction category 2 shall be considered to have endocrine disrupting properties. However, the interim criteria were never properly implemented in the EU, as no pesticide substance authorisation was ever refused because it met the interim criteria. The scientific and political discussion on how to identify EDCs had closely been accompanied by PAN Europe and partner groups<sup>18</sup>. After a delay of five years the European Commission finally adopted criteria for the identification of ED pesticides which came into effect

<sup>15</sup> US EPA (2019): Technical Overview of Ecological Risk Assessment Analysis Phase: Ecological Effects Characterization, U.S. Environmental Protection Agency, Washington, DC <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0>

<sup>16</sup> Commission Regulation (EU) 2018/605 of 19 April 2018: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R0605>

<sup>17</sup> laid down in REGULATION (EC) No 1107/2009

<sup>18</sup> PAN Europe Information on endocrine disrupting pesticides: <http://www.disruptingfood.info/en/>

November 2018. But it will take years for identifying pesticides with ED properties accordingly.

**Sources used:**

EC (2000): Towards the establishment of a priority list of substances for further evaluation of their role in endocrine disruption – preparation of a candidate list of substances as a basis for priority setting, European Commission, Delft

EC (2004): Commission Staff Working Document SEC (2004) 1372 on implementation of the Community Strategy for Endocrine Disruptors – a range of substances suspected of interfering with the hormone systems of humans and wildlife (COM (1999) 706), European Commission, Brussels

EC (2007): Commission staff working document on the implementation of the “Community Strategy for Endocrine Disruptors” – a range of substances suspected of interfering with the hormone systems of humans and wildlife (COM (1999) 706), (COM (2001) 262) and (SEC (2004) 1372). SEC(2007) 1635. European Commission (EC). Brussels, 30.11.2007

EC (2008-2018): Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. Official Journal of the European Union L 353/1 and its amendments

EC (2009): Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC. Official Journal of the European Union, L 309, 24.11.2009

**Supplementary information:**

PAN Europe (2016): Impact Assessment of the criteria for endocrine disrupting pesticides. Online report, Brussels. <http://www.pan-europe.info/sites/pan-europe.info/files/public/resources/reports/pan-report-impact-endocrine-criteria-2016.pdf>

PAN Europe (2017). Endocrine Disrupting Pesticides in European Food. Annex 1. List of Endocrine Disrupting Pesticides identified by PAN Europe. [http://www.pan-europe.info/sites/pan-europe.info/files/public/resources/reports/Report\\_ED%20pesticides%20in%20EU%20food\\_PAN%20Europe.pdf](http://www.pan-europe.info/sites/pan-europe.info/files/public/resources/reports/Report_ED%20pesticides%20in%20EU%20food_PAN%20Europe.pdf)

**International Regulations**

The **Stockholm Convention** aims at the global elimination of Persistent Organic Pollutants (POPs), some of the most unwanted chemicals in the world. POPs are toxic, bioaccumulative, highly persistent, capable of long-range transport and pose a global threat to living beings, especially in the Arctic and Antarctic regions where they biomagnify. All marketed pesticides formally listed under the Stockholm Convention or meeting the criteria of the Stockholm Convention are on the PAN list of HHP.

The **Rotterdam Convention** on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade regulates the exchange of information in international trade on certain hazardous pesticides (active ingredients and formulations). All pesticides formally listed under the Rotterdam Convention or agreed by the Convention’s Chemical Review Committee and by the Conference of the Parties (CoP) as meeting the criteria of the Convention (but yet not listed for political or trade reasons which are not consistent with the text or intent of the Convention) are on the PAN list of HHPs.

Certain pesticide formulations are included in Annex 3 of the Rotterdam Convention as Severely Hazardous Pesticide Formulations (SHPFs). It is important to note that active

ingredients in these SHPFs are included in the PAN list even though they are regulated only in specific formulations. These active ingredients are identified in the list.

The **Montreal Protocol** on Substances that Deplete the Ozone Layer is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. Currently, there is one pesticide listed as an ozone depleting chemical. This pesticide (methyl bromide) is on the PAN list of HHPs.

**Sources used:**

Website of the Stockholm Convention at <http://www.pops.int>; Website of the Rotterdam Convention at <http://www.pic.int>; Website of Montreal Protocol at <http://ozone.unep.org>

**Toxicity to aquatic organisms**

The U.S. EPA Office of Pesticide Programs summarises the toxicity of pesticides to certain species groups. The ecological effect characterisation uses a three to five-step scale.<sup>19</sup> Pesticides characterised as *very highly toxic to aquatic organisms*, have a lethal or environmental concentration LC/EC50 [48h] of < 0.1mg/l. These pesticides are listed in the PAN HHP list **IF** they are also persistent or bioaccumulative.

**Source used:**

Lewis KA, Tzilivakis J, Warner D & Green A (2018): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242

**Ecosystem services – pollination by bees**

The U.S. EPA Office of Pesticide Programs, after reviewing individual toxicity or ecological effect studies for a pesticide, summarises the toxicity of pesticides to certain species groups. In developing its ecological effect characterisation, EPA uses a three-step scale<sup>20</sup> of toxicity categories to classify pesticides based on bee toxicity data. All pesticides classified as ‘highly toxic to bees’ are listed in the PAN HHP list.

**Source used:**

Lewis KA, Tzilivakis J, Warner D & Green A (2018): An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, In Press. doi:10.1080/10807039.2015.1133242

---

<sup>19</sup> <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0>

<sup>20</sup> <https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0>

## Method applied to identify highly hazardous pesticides

The classification systems and lists mentioned above have been integrated by PAN in a relational pesticide database consisting of numerous tables representing the classification systems and lists. Either CAS numbers or unique identification numbers (IDs) are used to match fields between the tables. Data were usually imported from Excel, Access or PDF files. A table (list) of all pesticides is linked to all tables containing classification systems and lists mentioned above, and this table/list was searched for the criteria defining highly hazardous pesticides. Pesticides which are considered to be 'obsolete' by the WHO/IPCS were omitted, except any obsolete pesticides which were found on current authorisation lists.

The Pesticide Properties Database (by Lewis et al.) has been used to identify pesticides with the characteristics of being toxic to bees (LD50 <2 microgram/bee); persistent, bioaccumulative and/or highly toxic to aquatic organisms (LC/EC50 *Daphnia* spp. < 0.1 mg/l).

## Evolution of the PAN List of Highly Hazardous Pesticides

The number of active ingredients on the PAN HHP List changes over time. The reasons for changes are mainly changes in classifications made by organisations referred to in this list such as WHO, EU, EPA or IARC. In 2010, for example, more pesticides were classified as toxic to bees and as persistent. In 2013, numerous substances, which are not agricultural pesticides or obsolete, were deleted. Even though 12 pesticides were added to the 2015 version due to new data or classification changes the June 2015 version was significantly shorter than versions before 2014. The main reasons were: (a) the deletion of those pesticides classified as "possible carcinogens", and (b) the required combination of two of the three Persistence, Bioaccumulative and Toxic characteristics (i.e. P&B; B&T or P&T).

### Pesticides *added* to the PAN HHP List since January 2009

#### 2009-2011

Alanycarb  
Amidosulfuron  
Asulam, sodium salt  
Benfuracarb  
Bensulide  
beta-HCH; beta-BCH  
Bioresmethrin  
Blastidicin-S  
Borax; disodium tetraborate decahydrate  
Boric acid  
Carbosulfan  
Chlordimeform  
Chlorphropham  
Clopyralid  
Cyhalothrin  
Cyhalothrin, gamma  
Diafenthiuron  
Dimefuron  
Dimoxystrobin  
Dinotefuran  
Diquat dichloride  
Dithianon  
E-Phosphamidon

EPTC  
Ethaboxam  
Ethirimol  
Fenclorazole-ethyl  
Fenothiocarb  
Fenpropidin  
Flufenoxuron  
Glufosinate-ammonium  
Lenacil  
Metazachlor  
Metobromuron  
Metoxuron  
Metsulfuron-methyl  
Milbemectin  
Naled  
Napropamide  
Nicosulfuron  
Nitenpyram  
Nitrobenzene  
Oxycarboxin  
Penconazole  
Pentachlorobenzene  
Pirimiphos-methyl  
Prallethrin  
Profenofos

Pyraclufos  
Pyrazophos  
Pyridaben  
Pyridiphenthion  
Pyrifenox  
Quinmerac  
Rotenone  
Silafloufen  
Sintofen  
Temephos  
Tralomethrin  
Tributyltin compounds  
Tridiphane  
Validamycin  
XMC

#### Since 2011

Penthiopyrad  
Penflufen  
Sedaxane  
o-phenylphenol  
**Group:** Paraffin oils, Mineral oils  
*Paraffin oil (see group table)*  
Isopyrazam

Amisulbrom  
Spinetoram  
Pyridalyl  
Penflufen  
Isopyrazam  
Ipconazole  
Penthiopyrad  
Sedaxane  
Fluxapyroxad  
Metazachlor  
Fuberidazole  
Oxadiargyl  
Zinc phosphide  
Cyflufenamid

**Since June 2013**

Magnesium phosphide  
Proquinazid  
Aclonifen  
Imiprothrin  
Sulfoxaflor  
Climbazole  
Metaflumizone  
Aminocyclopyrachlor

**Since November 2013**

Anthraquinone  
Bromoxynil heptanoate  
Bromoxynil octanoate  
Chlorantraniliprole  
Chlorfluazuron  
Copper (II) hydroxide  
Fluazolate  
Flumetralin  
Halfenprox  
Prothiofos  
Pyrazachlor  
Tolfenpyrad

**Since June 2014**

Glyphosate

**Since June 2015**

Pendimethalin  
Triflumizole  
Group: Borax, borate salts (*see table Grouped Pesticides below*)

**Since December 2016**

Carbetamide  
Cyanamide  
Chlorophene; 2-benzyl-4-chlorophenol  
Dicofol  
Emamectin benzoate  
Fenpyroximate  
Quinolin-8-ol; 8-hydroxyquinoline  
Sulfuramide  
Triadimenol

**Since March 2018**

Calcium cyanide  
Cyproconazole  
Flupyradifurone  
*Group: Glyphosate and its salts (see group table)*  
Noviflumuron  
Propiconazole  
Propineb  
Sodium cyanide  
Tioxafen  
Hydrogen cyanide

## Pesticides *deleted* from the PAN HHP List since January 2009

### 2009-2011

2,4-dichlorophenol  
Bacillus subtilis GBO3  
Chlordimeform hydrochloride  
Chlorsulfuron  
Sulfosulfuron

### Since 2011

1,2,4-triazole  
2,4,6-trichlorophenol  
2,6-Dichlorbenzamid  
Aniline  
Azobenzene  
Bis (chloroethyl) ether  
Chlorbenside  
Coconut diethanolamide  
Dichloro acetic acid  
Dimethoxane  
Doxorubicin  
Heptachlor epoxide  
Hydrazine  
Isophorone  
Mepronil  
Methylene chloride  
P-chloroaniline  
Pentachlorbenzene  
Picloram, diethanolamine salt  
piperonyl butoxid  
Trichlorophenol  
Tridiphane

### Since June 2013

2,4,5-T (2,4,5-trichlorophenoxy acetic acid)  
Aldrin  
Binapacryl  
Chlordimeform  
Chlorobenzilate  
Cholecalciferol; Vitamin D3  
Dieldrin  
Dinoseb  
Endrin  
Heptachlor  
Mirex  
Toxaphene  
Metobromuron  
Chlordecone  
8-hydroxyquinoline  
Oxadiargyl  
Methyl isothiocyanate

### Since November 2013

2,4,5-T, butyric acid  
2,4,5-trichlorophenol  
2,4-D  
2,4-DP, isoocetyl ester  
3-CPA  
Acifluorfen, sodium salt  
Aclonifen  
Allethrin; Bioallethrin  
Amidosulfuron  
Aminocyclopyrachlor  
Aminopyralid  
Amitraz  
Asulam  
Asulam, sodium salt  
Azoxystrobin  
Benfluralin  
Bentazone  
Boscalid; Nicobifen; BAS 510 F  
Bromacil  
Bromuconazole  
Buprofezin  
Captan

Chlorpropham  
Chlorzolinate  
Cinidon-ethyl  
Clodinafop-propargyl  
Clofencet  
Clofentezine  
Clopyralid  
Cumyluron  
Cyanazine  
Cyproconazole  
Cyromazine  
Dacthal (DCPA); Chlorthal-dimethyl  
Dichlobenil  
Dichlorophene  
Dichlorprop-P  
Dicofol  
Difenoconazole  
Dimefuron  
Dimethenamid  
Dimethipin  
Dithianon  
Esbiothrin; S-Bioallethrin  
Ethaboxam  
Ethalfuralin  
Ethiozin  
Ethiprole  
Ethofumesate  
Fenbuconazole  
Fenpropidin  
Fonicamid  
Fluazinam  
Fludioxonil  
Fluometuron  
Fluopicolide  
Flutolanil  
Fluxapyroxad  
Forchlorfenuron  
Fuberidazole  
Furfural; 2-furaldehyde  
Glyphosate trimesium  
Hexachloroethane  
Hexaconazole  
Hydramethylnon  
Hydrogen cyanamide  
Imazaquin  
Iodomethane  
Ipconazole  
Isoproturon  
Isoxaben  
Lactofen  
Lenacil  
MCPA  
MCPB  
MCPP  
Mecoprop-P  
Mercaptobenzothiazole, 2-  
Metaldehyde  
Metazachlor  
Metconazole  
Methylphenol, 3-; Meta-Cresol  
Metolachlor  
Metoxuron  
Metrafenone  
Metronidazole  
Metsulfuron-methyl  
Myclobutanil  
Napropamide  
Nicosulfuron  
Norflurazon  
O-phenylphenol  
Orthosulfamuron  
Oxadixyl  
Oxycarboxin  
Paclobutrazol

p-Dichlorobenzene; Paradichlorobenzene  
Penconazole  
Pendimethalin  
Penflufen  
Penoxsulam  
Penthiopyrad  
Piperonyl butoxide  
Polyhexamethylene biguanide (PHMB)  
Prochloraz  
Prodiamine  
Prometryn  
Propanil  
Propazine  
Propiconazole  
Proquinazid  
Prosulfocarb  
Pyrasulfotole  
Pyrethrins  
Pyrifenoxy  
Pirimethanil  
Pyriithiobac-sodium  
Pyroxasulfone  
Quinmerac  
Quintozene; (PCNB)  
Silthiofam  
Simazine  
Sintofen  
S-Metolachlor  
Tebuconazole  
Tebufenpyrad  
Tembotrione  
Thiabendazole  
Thiazopyr  
Topramezone  
Tralkoxydim  
Triadimefon  
Triadimenol  
Triasulfuron  
Tribenuron methyl  
Tribufos  
Triclosan  
Tricyclazole  
Triflusaluron-methyl  
Triforine  
Triticonazole  
Uniconazole

### Since June 2014

Fluopyram

### Since June 2015

Imazethapyr

### Since December 2016

MGK 326  
Propyzamide

### Since March 2018

Cyflufenamid  
Sedaxane  
Nitrapyrin  
Sodium dimethyl dithio carbamate

## Explanatory notes regarding the table of active ingredients

WHO Ia:	Extremely hazardous (Class 1a) according to World Health Organisation
WHO Ib:	Highly hazardous (Class 1b) according to World Health Organisation
H330	' <i>Fatal if inhaled</i> ', hazard classification according to the Globally Harmonised System (GHS)
max = 1	This active ingredient meets at least one criterion in this Group
EPA carc	Human carcinogen according to EPA
IARC carc	Human carcinogen according to IARC
EU GHS (1A, 1B):	Known or presumed human carcinogens (1A or 1B) according to EU GHS Regulation 1272/2008/EC
EPA prob/likel carc	Probable/ Likely carcinogen according to EPA
IARC prob carc	Probable carcinogen according to IARC
EU GHS (2):	Suspected human carcinogen (Cat. 2) according to EU GHS Regulation 1272/2008/EC
EU GHS muta (1A, 1B)	Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans. Substances known to induce heritable mutations in the germ cells of humans' (Category 1A or 1B) according to EU Regulation 1272/2008/EC
EU GHS repro (1A, 1B):	Known or presumed human reproductive toxicant according to EU GHS Regulation 1272/2008/EC
EU EDC (1) or C2 & R2 GHS:	Endocrine disruptor or potential endocrine disruptor according to EU Category 1 or pesticides classified GHS Carcinogen Category 2 AND EU Reproductive Category 2
Very bio acc:	Very bioaccumulative (BCF >5000) or Kow logP >5 (BCF values supersede Kow logP data)
Very persistent water, soil or sediment:	Very persistent in water (half-life > 60 days), soils or sediments (half-life > 180 days)
Very toxic to aq. Organism:	Very toxic to aquatic organisms (Acute LC/EC50 <0,1 mg/l for Daphnia species)
Highly toxic bees:	Hazard to ecosystem services – Highly toxic to bees (<2 µg/bee) according to U.S. EPA as listed by FOOTPRINT data
Montr Prot:	Ozone depleting chemical according to the Montreal Protocol
PIC:	Listed in Annex III of the Rotterdam Convention or meeting the criteria for being listed
POP:	Listed in Annex III of the Stockholm Convention or meeting the criteria for being listed

## Grouped Pesticides

Some pesticides are grouped in the list as follows:

Group/ pesticides	CAS Number
<b>Arsenic and its compounds</b>	
<i>Arsenic pentoxide</i>	1303-28-2
<i>Arsenic pentoxide hydrate</i>	12044-50-7
<i>Arsenic trioxide</i>	1327-53-3
<i>Cacolydate; sodium dimethylarsinate</i>	124-65-2
<i>Calcium arsenate</i>	7778-44-1
<i>Chromated copper arsenate; CCA</i>	75-60-5
<i>Copper arsenate</i>	7778-41-8
<i>DSMA; Disodium methanearsonate</i>	144-21-8
<i>Lead arsenate</i>	7784-40-9
<i>MAA, methylarsonic acid</i>	124-58-3
<i>MSMA</i>	2163-80-6
<i>MSMA, calcium salt</i>	5902-95-4
<i>Paris Green</i>	12002-03-8
<i>Sodium arsenate</i>	13464-38-5
<i>Sodium arsenite</i>	7784-46-5
<b>Borax; Borate salts</b>	
<i>Borax, disodium octaborate anhydrous</i>	12008-41-2
<i>Borax, disodium octaborate tetrahydrate</i>	12280-03-4
<i>Borax, disodium tetraborate decahydrate</i>	1303-96-4
<b>DNOC and its salts</b>	
<i>DNOC, ammonium salt</i>	2980-64-5
<i>DNOC, potassium salt</i>	5787-96-2
<i>DNOC, sodium salt</i>	2312-76-7
<i>DNOC</i>	534-52-1
<b>Glyphosate and its salts</b>	
<i>Glyphosate (acid)</i>	1071-83-6
<i>Glyphosate-diammonium</i>	69254-40-6
<i>Glyphosate-isopropylamine (-isopropylammonium;-IPA)</i>	38641-94-0
<i>Glyphosate-monoammonium</i>	40465-66-5
<i>Glyphosate-sodium</i>	34494-03-6
<i>Glyphosate-trimesium</i>	81591-81-3
<b>Mercury and its compounds</b>	
<i>2-Acetoxymercuricethanol phenylmercuric lactate</i>	4665-55-8
<i>Chloromethoxypropylmercuric acetate; CPMA</i>	1319-86-4

<i>Cyanomethylmercuricguanidine</i>	502-39-6
<i>Diphenylmercurydodecenylsuccinate; PMDS</i>	27236-65-3
<i>Hydroxymercuri-o-nitrophenol</i>	17140-73-7
<i>Mercuric acetate</i>	1600-27-7
<i>Mercuric chloride</i>	7487-94-7
<i>Mercuric oxide</i>	21908-53-2
<i>Mercurous chloride</i>	7546-30-7
<i>Mercury</i>	7439-97-6
<i>Mercury naphthenate</i>	1336-96-5
<i>Mercury oleate</i>	1191-80-6
<i>Mercury pentanedione</i>	14024-55-6
<i>Mercury phenate</i>	589-66-9
<i>Methoxyethylmercuric acetate</i>	151-38-2
<i>Methoxyethylmercuric chloride</i>	123-88-6
<i>Methylmercury 2,3 dihydroxypropyl mercaptide</i>	2597-95-7
<i>Methylmercury 8-quinolinolate</i>	86-85-1
<i>Methylmercury acetate</i>	108-07-6
<i>Methylmercury benzoate</i>	3626-13-9
<i>Methylmercury hydroxide</i>	1184-57-2
<i>Methylmercury nitrite</i>	2591-97-9
<i>Methylmercury propionate</i>	5903-10-6
<i>N-Phenylmercuric urea</i>	2279-64-3
<i>Phenylethylmercuric salicylate</i>	54-64-8
<i>Phenylmercuric ammonium acetate</i>	53404-67-4
<i>Phenylmercuric ammonium propionate</i>	53404-68-5
<i>Phenylmercuric borate</i>	102-98-7
<i>Phenylmercuric carbonate</i>	53404-69-6
<i>Phenylmercuric chloride</i>	100-56-1
<i>Phenylmercuric dimethyldithiocarbamate</i>	32407-99-1
<i>Phenylmercuric formamide</i>	22894-47-9
<i>Phenylmercuric hydroxide</i>	100-57-2
<i>Phenylmercuric lactate</i>	122-64-5
<i>Phenylmercuric laurylmercaptide</i>	unknown
<i>Phenylmercuric monoethanol ammonium acetate</i>	5822-97-9
<i>Phenylmercuric monoethanol ammonium lactate</i>	53404-70-9
<i>Phenylmercuric naphthenate</i>	31632-68-5
<i>Phenylmercuric nitrate</i>	55-68-5
<i>Phenylmercuric oleate; PMO</i>	104-68-9
<i>Phenylmercuric propionate</i>	103-27-5
<i>Phenylmercuric salicylate</i>	28086-13-7
<i>Phenylmercuric thiocyanate</i>	16751-55-6

<i>Phenylmercuric threthanolammonium lactate</i>	23319-66-6
<i>phenylmercuric-2-ethylhexonate</i>	13302-00-6
<i>phenylmercuric-8-quinolinate</i>	26114-17-0
<i>Phenylmercury acetate; PMA</i>	62-38-4
<b>Tributyltin compounds</b>	
<i>Tributyltin oxide</i>	56-35-9
<i>Tributyltin fluoride</i>	1983-10-4
<i>Tributyltin methacrylate</i>	2155-70-6
<i>Tributyltin benzoate</i>	4342-36-3
<i>Tributyltin chloride</i>	1461-22-9
<i>Tributyltin linoleate</i>	24124-25-2
<i>Tributyltin naphthenate</i>	85409-17-2
<b>Paraffin oils; mineral oils containing &gt; 3% Dimethylsulfoxid (DMSO)</b>	
<i>Paraffin oil</i>	64741-88-4
<i>Paraffin oil</i>	64741-89-5
<i>Paraffin oil</i>	64741-97-5
<i>Paraffin oil</i>	64742-46-7
<i>Paraffin oil</i>	64742-54-7
<i>Paraffin oil</i>	64742-55-8
<i>Paraffin oil</i>	64742-65-0
<i>Paraffin oil</i>	72623-86-0
<i>Paraffin oil</i>	97862-82-3

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions							
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or organism	highly toxic bees max = 1	Montr Prot	PLC	See note below the table	POP	max = 1			
					28	49	50	103	1	3	13	7	70	4	30	55	141	22	18	30	116	148	1	32		9	36
1	542-75-6	1,3-dichloropropene		1			0					1			1					0						0	
2	94-82-6	2,4-DB		1			0							1	1					0						0	
3	71751-41-2	Abamectin		2			1	1							0				1	1						0	
4	30560-19-1	Acephate		1			0								0				1	1						0	
5	34256-82-1	Acetochlor		1			0							1	1					0						0	
6	101007-06-1	Acrinathrin		1			0								0				1	1						0	
7	107-02-8	Acrolein		1		1	1	1							0					0						0	
8	15972-60-8	Alachlor		2			0								1	1				0	1					1	
9	83130-01-2	Alanycarb		1			0								0				1	1						0	
10	116-06-3	Aldicarb		3	1		1	1							0				1	1	1					1	
11	319-84-6	alpha-BHC; alpha-HCH		1			0								0					0				1		1	
12	96-24-2	Alpha-chlorohydrin		1		1	1								0					0						0	
13	20859-73-8	Aluminum phosphide		2			1	1							0				1	1						0	
14	348635-87-0	Amisulbrom		1			0								0		1	1		1						0	
15	61-82-5	Amitrole		1			0							1	1					0						0	
16	90640-80-5	Anthracene oil		1			0			1					1					0						0	

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions								
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
17	84-65-1	Anthraquinone		1				0					1	1			1						0					0
18	for CAS number see list of grouped pesticides	Arsen and its compounds	x	1				0	1	1	1						1						0					0
19	1912-24-9	Atrazine		1				0							1		1						0					0
20	68049-83-2	Azafenidin		1				0						1			1						0					0
21	35575-96-3	Azamethiphos		1				0									0				1	1						0
22	2642-71-9	Azinphos-ethyl		2		1		1									0				1	1						0
23	86-50-0	Azinphos-methyl		3		1	1	1									0				1	1		1				1
24	41083-11-8	Azocyclotin		2			1	1									0	1		1			1					0
25	22781-23-3	Bendiocarb		1				0									0				1	1						0
26	82560-54-1	Benfuracarb		1				0									0				1	1						0
27	17804-35-2	Benomyl		2				0						1	1		1						0	1	X			1
28	741-58-2	Bensulide		1				0									0				1	1						0
29	177406-68-7	Benthiavalicarb-isopropyl		1				0					1				1						0					0
30	68359-37-5	Beta-cyfluthrin; Cyfluthrin		2		1	1	1									0				1	1						0
31	319-85-7	beta-HCH; beta-BCH		2				0								1	1						0			1	1	
32	82657-04-3	Bifenthrin		2				0								1	1				1	1						0
33	28434-01-7	Bioresmethrin		1				0									0				1	1						0

## PAN International List of Highly Hazardous Pesticides – March 2019

		Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions										
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
34	2079-00-7	Blasticidin-S		1		1		1									0						0					0
35	1303-96-4	Borax; Borate salts		1				0							1		1						0					0
36	10043-35-3	Boric acid		1				0						1	1	1							0					0
37	56073-10-0	Brodifacoum		2	1		1	1						1		1							0					0
38	28772-56-7	Bromadiolone		2	1		1	1						1		1							0					0
39	63333-35-7	Bromethalin		2	1			1									0	1		1			1					0
40	1689-84-5	Bromoxynil		1			1	1									0						0					0
41	56634-95-8	Bromoxynil heptanoate		1				0									0	1		1			1					0
42	1689-99-2	Bromoxynil octanoate		1				0									0	1		1			1					0
43	23184-66-9	Butachlor		1				0					1				1						0					0
44	34681-10-2	Butocarboxim		1				0									0					1	1					0
45	34681-23-7	Butoxycarboxim		1		1		1									0						0					0
46	95465-99-9	Cadusafos		2		1		1									0		1	1	1	1	1					0
47	2425-06-1	Captafol		3	1			1		1	1	1					1						0	1				1
48	592-01-8	Calcium cyanide		1	1			1									0						0					0
49	63-25-2	Carbaryl		2				0					1		1	1						1	1					0
50	10605-21-7	Carbendazim		1				0						1	1	1							0					0

**PAN International List of Highly Hazardous Pesticides – March 2019**

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or organism	highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
51	16118-49-3	Carbetamide		2			0						1		1					0		1			1
52	1563-66-2	Carbofuran		3		1	1								0				1	1		1	X		1
53	55285-14-8	Carbosulfan		3			1								0				1	1		1	C <sub>PIC</sub>		1
54	2439-01-2	Chinomethionat; Oxythioquinox		1			0				1				1					0					0
55	500008-45-7	Chlorantraniliprole		1			0								0		1	1		1					0
56	57-74-9	Chlordane		3			0					1		1	1	1				1		1		1	1
57	54593-83-8	Chlorethoxyphos		2	1		1								0				1	1					0
58	122453-73-0	Chlorfenapyr		1			0								0				1	1					0
59	470-90-6	Chlorfenvinphos		2		1	1								0				1	1					0
60	71422-67-8	Chlorfluazuron		1			0								0	1		1		1					0
61	24934-91-6	Chlormephos		1	1		1								0					0					0
62	67-66-3	Chloroform		1			0					1			1					0					0
63	3691-35-8	Chlorophacinone		1	1		1								0					0					0
64	120-32-1	Chlorophene; 2-benzyl- 4-chlorophenol		1			0							1	1					0					0
65	76-06-2	Chloropicrin		1		1	1								0					0					0
66	1897-45-6	Chlorothalonil		2		1	1					1			1					0					0
67	15545-48-9	Chlorotoluron		1			0							1	1					0					0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions								
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
68	2921-88-2	Chlorpyrifos		1				0									0					1	1					0
69	5598-13-0	Chlorpyrifos-methyl		1				0									0					1	1					0
70	38083-17-9	Climbazole		1				0									0					1	1					0
71	210880-92-5	Clothianidin		1				0									0					1	1					0
72	20427-59-2	Copper (II) hydroxide		2			1	1									0		1	1				1				0
73	56-72-4	Coumaphos		2		1	1	1							1		1							0				0
74	5836-29-3	Coumatetralyl		2		1	1	1							1		1							0				0
75	8001-58-9	Creosote		1				0			1	1	1				1							0				0
76	420-04-2	Cyanamide; Hydrogen cyanamide		1				0								1	1							0				0
77	68085-85-8	Cyhalothrin		1				0									0					1	1					0
78	76703-62-3	Cyhalothrin, gamma		1				0									0					1	1					0
79	13121-70-5	Cyhexatin		1				0									0	1		1				1				0
80	52315-07-8	Cypermethrin		1				0									0					1	1					0
81	67375-30-8	Cypermethrin, alpha		1				0									0					1	1					0
82	65731-84-2	Cypermethrin, beta		1				0									0					1	1					0
83	94361-06-5	Cyproconazole		1				0							1		1							0				0
84	1596-84-5	Daminozide		1				0					1				1							0				0

**PAN International List of Highly Hazardous Pesticides – March 2019**

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions									
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PLC	See note below the table	POP	max = 1	
85	50-29-3	DDT		3				0					1			1	1		1	1			1		1			1	1
86	52918-63-5	Deltamethrin		2				0								1	1					1	1						0
87	919-86-8	Demeton-S-methyl		2		1		1									0					1	1						0
88	80060-09-9	Diafenthion		1				0									0					1	1						0
89	333-41-5	Diazinon		2				0				1					1					1	1						0
90	62-73-7	Dichlorvos; DDVP		2		1	1	1									0					1	1						0
91	51338-27-3	Diclofop-methyl		1				0					1				1							0					0
92	115-32-2	Dicofol		1				0									0									C <sub>POP</sub>	1		1
93	141-66-2	Dicrotophos		2		1		1									0					1	1						0
94	56073-07-5	Difenacoum		2	1			1									0	1						1					0
95	104653-34-1	Difethialone		2	1		1	1						1			1							0					0
96	60-51-5	Dimethoate		1				0									0					1	1						0
97	149961-52-4	Dimoxystrobin		2				0								1	1		1	1			1						0
98	39300-45-3	Dinocap		1				0						1			1							0					0
99	165252-70-0	Dinotefuran		1				0									0					1	1						0
100	1420-07-1	Dinoterb		2		1		1						1			1							0					0
101	82-66-6	Diphacinone		1	1			1									0							0					0
102	85-00-7	Diquat dibromide		1			1	1									0							0					0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or organism	highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
103	4032-26-2	Diquat dichloride		1		1	1								0					0				0	
104	298-04-4	Disulfoton		1		1									0					0				0	
105	330-54-1	Diuron		1		0					1				1					0				0	
106	for CAS number see list of grouped pesticides	DNOC and its salts	x	2		1	1	1							0					0		1		1	
107	17109-49-8	Edifenphos		1		1									0					0				0	
108	155569-91-8	Emamectin benzoate		1		0									0		1	1	1	1				0	
109	115-29-7	Endosulfan		2		1	1								0					0		1	1	1	
110	297-99-4	E-Phosphamidon		1	1		1								0					0				0	
111	106-89-8	Epichlorohydrin		1		0			1	1	1			1	1					0				0	
112	2104-64-5	EPN		2	1		1								0			1	1	1				0	
113	133855-98-8	Epoxiconazole		1		0					1		1	1	1					0				0	
114	66230-04-4	Esfenvalerate		1		0									0			1	1	1				0	
115	29973-13-5	Ethiofencarb		1		1									0					0				0	
116	23947-60-6	Ethirimol		1		0									0			1	1	1				0	
117	13194-48-4	Ethoprophos; Ethoprop		2	1	1	1				1				1					0				0	
118	106-93-4	Ethylene dibromide; 1,2-dibromoethane		2		0			1	1	1			1	1					0		1		1	
119	107-06-2	Ethylene dichloride; 1,2-Dichloroethane		2		0			1		1				1					0		1		1	

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions								
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PlC	See note below the table	POP	max = 1
120	75-21-8	Ethylene oxide		2				0		1	1			1			1						0		1			1
121	96-45-7	Ethylene thiourea		1				0					1		1	1	1						0					0
122	80844-07-1	Etofenprox; Ethofenprox		1				0									0		1	1	1	1	1					0
123	52-85-7	Famphur		1		1		1									0						0					0
124	22224-92-6	Fenamiphos		2		1	1	1									0					1	1					0
125	60168-88-9	Fenarimol		1				0								1	1						0					0
126	120928-09-8	Fenazaquin		1				0									0					1	1					0
127	13356-08-6	Fenbutatin-oxide		2			1	1									0		1	1			1					0
128	103112-35-2	Fenchlorazole-ethyl		1				0			1						1						0					0
129	122-14-5	Fenitrothion		2				0								1	1					1	1					0
130	72490-01-8	Fenoxycarb		2				0					1				1						1	1				0
131	39515-41-8	Fenpropathrin		2			1	1									0					1	1					0
132	134098-61-6	Fenpyroximate		1			1	1									0						0					0
133	55-38-9	Fenthion / Fenthion > 640g/L		2				0									0					1	1		1	CF		1
134	900-95-8	Fentin acetate; Triphenyltin acetate		2			1	1								1	1						0					0
135	76-87-9	Fentin hydroxide; Triphenyltin hydroxide		2			1	1					1			1	1						0					0
136	51630-58-1	Fenvalerate		1				0									0					1	1					0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or organism	highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
137	120068-37-3	Fipronil		1			0								0				1	1				0	
138	90035-08-8	Flocoumafen		2	1		1							1	1						0			0	
139	69806-50-4	Fluazifop-butyl		1			0							1	1						0			0	
140	174514-07-9	Fluazolate		1			0								0	1		1		1				0	
141	272451-65-7	Flubendiamide		1			0								0		1	1		1				0	
142	70124-77-5	Flucythrinate		2		1	1								0				1	1				0	
143	101463-69-8	Flufenoxuron		1			0								0	1		1		1				0	
144	62924-70-3	Flumetralin		1			0								0	1		1		1				0	
145	103361-09-7	Flumioxazin		1			0							1	1						0			0	
146	640-19-7	Fluoroacetamide		2		1	1								0						0	1		1	
147	951659-40-8	Flupyradifurone		1			0								0				1	1					
148	85509-19-9	Flusilazole		1			0							1	1						0			0	
149	117337-19-6	Fluthiacet-methyl		1			0					1			1						0			0	
150	133-07-3	Folpet		1			0					1			1						0			0	
151	50-00-0	Formaldehyde		1			0		1			1			1						0			0	
152	22259-30-9	Formetanate		2		1	1	1							0				1	1				0	
153	98886-44-3	Fosthiazate		1			0								0				1	1				0	
154	65907-30-4	Furathiocarb		1		1	1	1							0						0			0	

**PAN International List of Highly Hazardous Pesticides – March 2019**

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity				Group 4 Conventions						
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
155	121776-33-8	Furilazole		1			0					1			1						0				0
156	77182-82-2	Glufosinate-ammonium		1			0							1	1						0				0
157	for CAS number see list of grouped pesticides	Glyphosate	x	1			0				1				1						0				0
158	111872-58-3	Halfenprox		1			0								0	1		1		1					0
159	69806-40-2	Haloxypop-methyl (unstated stereochemistry)		1			0					1			1						0				0
160	23560-59-0	Heptenophos		2		1	1								0				1	1					0
161	118-74-1	Hexachlorobenzene		4	1		1			1		1		1	1	1					1	1		1	1
162	86479-06-3	Hexaflumuron		1			0								0				1	1					0
163	608-73-1	Hexchlorocyclohexane; BHC mixed isomers		2			0					1		1	1						0	1			1
164	78587-05-0	Hexythiazox		1			0					1			1						0				0
165	74-90-8	Hydrogen cyanide		1		1	1								0						0				0
166	35554-44-0	Imazalil		1			0					1			1						0				0
167	138261-41-3	Imidacloprid		1			0								0				1	1					0
168	72963-72-5	Imiprothrin		1			0								0				1	1					0
169	173584-44-6	Indoxacarb		1			0								0				1	1					0
170	1689-83-4	loxynil		1			0							1	1						0				0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
171	36734-19-7	Iprodione		1			0					1			1					0					0
172	140923-17-7	Iprovalicarb		1			0					1			1					0					0
173	881685-58-1	Isopyrazam		2			0					1			1		1	1	1						0
174	141112-29-0	Isoxaflutole		1			0					1			1					0					0
175	18854-01-8	Isoxathion		2		1	1								0				1	1					0
176	143390-89-0	Kresoxim-methyl		1			0					1			1					0					0
177	91465-08-6	Lambda-cyhalothrin		3			1	1						1	1				1	1					0
178	58-89-9	Lindane		3			0							1	1				1	1		1		1	1
179	330-55-2	Linuron		1			0						1	1	1					0					0
180	103055-07-8	Lufenuron		1			0								0	1	1	1		1					0
181	12057-74-8	Magnesium phosphide		1			1	1							0					0					0
182	121-75-5	Malathion		2			0				1				1				1	1					0
183	8018-01-7	Mancozeb		1			0					1		1	1					0					0
184	12427-38-2	Maneb		1			0					1		1	1					0					0
185	2595-54-2	Mecarbam		1		1	1								0					0					0
186	110235-47-7	Mepanipyrim		1			0					1			1					0					0
187	for CAS number see list of grouped pesticides	Mercury and its compounds	x	2			1	1							0					0		1			1

## PAN International List of Highly Hazardous Pesticides – March 2019

		Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions										
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
188	139968-49-3	Metaflumizone		1				0									0	1	1			1	1					0
189	137-41-7	Metam-potassium		1				0					1				1						0					0
190	137-42-8	Metam-sodium		1				0					1		1		1						0					0
191	18691-97-9	Methabenzthiazuron		1				0									0					1	1					0
192	10265-92-6	Methamidophos		3		1	1	1									0					1	1		1	X		1
193	950-37-8	Methidathion		2		1		1									0					1	1					0
194	2032-65-7	Methiocarb		2		1		1									0					1	1					0
195	16752-77-5	Methomyl		2		1		1									0					1	1					0
196	72-43-5	Methoxychlor		1				0							1		1						0					0
197	74-83-9	Methyl bromide		1				0									0						0	1				1
198	9006-42-2	Metiram		1				0					1		1		1						0					0
199	21087-64-9	Metribuzin		1				0							1		1						0					0
200	7786-34-7	Mevinphos		2	1			1									0					1	1					0
201	51596-10-2	Milbemectin		1				0									0					1	1					0
202	2212-67-1	Molinate		1				0							1		1						0					0
203	71526-07-3	MON 4660; AD 67		1				0					1				1						0					0
204	6923-22-4	Monocrotophos		3		1	1	1									0					1	1		1			1

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions								
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PlC	See note below the table	POP	max = 1
205	300-76-5	Naled		1				0									0					1	1					0
206	54-11-5	Nicotine		1		1	1	1									0						0					0
207	150824-47-8	Nitenpyram		1				0									0					1	1					0
208	98-95-3	Nitrobenzene		1				0						1	1	1							0					0
209	121451-02-3	Noviflumuron		1				0					1				1						0					0
210	1113-02-6	Omethoate		3		1		1							1	1	1					1	1					0
211	19044-88-3	Oryzalin		1				0					1				1						0					0
212	19666-30-9	Oxadiazon		1				0					1				1						0					0
213	23135-22-0	Oxamyl		2		1	1	1									0					1	1					0
214	301-12-2	Oxydemeton-methyl		2		1		1									0					1	1					0
215	42874-03-3	Oxyfluorfen		1				0					1				1						0					0
216	64741-88-4	Paraffin oils; mineral oils	x	1				0			1						1						0					0
217	1910-42-5	Paraquat dichloride / Paraquat dichloride >276g/L		2			1	1									0						0	1	CF		1	
218	56-38-2	Parathion		3	1			1									0					1	1	1				1
219	298-00-0	Parathion-methyl		2	1		1	1									0						0	1	X		1	
220	87-86-5	PCP; Pentachlorophenol		3		1	1	1					1		1	1							0	1				1

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
221	40487-42-1	Pendimethalin		1			0								0	1	1			1					0
222	52645-53-1	Permethrin		2			0					1			1					1	1				0
223	2597-03-7	Phenthoate		1			0								0					1	1				0
224	298-02-2	Phorate		2	1		1								0					1	1				0
225	732-11-6	Phosmet		1			0								0					1	1				0
226	13171-21-6	Phosphamidon		3	1		1								0					1	1	1	X		1
227	7803-51-2	Phosphine		1			1								0						0				0
228	1918-02-1	Picloram		1			0							1	1						0				0
229	23103-98-2	Pirimicarb		2			0					1			1		1	1			1				0
230	29232-93-7	Pirimiphos-methyl		1			0								0					1	1				0
231	299-45-6	Potasan		1			1								0						0				0
232	23031-36-9	Prallethrin		1			0								0					1	1				0
233	32809-16-8	Procymidone		1			0					1		1	1						0				0
234	41198-08-7	Profenofos		1			0								0					1	1				0
235	139001-49-3	Profoxydim		1			0							1	1						0				0
236	1918-16-7	Propachlor		1			0					1			1						0				0
237	2312-35-8	Propargite		2			0					1			1	1		1			1				0
238	31218-83-4	Propetamphos		1		1	1								0						0				0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions								
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
239	60207-90-1	Propiconazole		1				0							1		1						0					0
240	12071-83-9	Propineb		1				0					1				1						0					0
241	114-26-1	Propoxur		2				0					1				1					1	1					0
242	75-56-9	Propylene oxide, Oxirane		1				0			1		1	1			1						0					0
243	34643-46-4	Prothiofos		1				0									0	1			1		1					0
244	123312-89-0	Pymetrozine		1				0					1				1						0					0
245	77458-01-6	Pyraclufos		1				0									0					1	1					0
246	129630-19-9	Pyraflufen-ethyl		1				0					1				1						0					0
247	6814-58-0	Pyrazachlor		1				0					1				1						0					0
248	13457-18-6	Pyrazophos		1				0									0					1	1					0
249	108-34-9	Pyrazoxon		1			1	1									0						0					0
250	96489-71-3	Pyridaben		1				0									0					1	1					0
251	179101-81-6	Pyridalyl		1				0									0	1	1	1			1					0
252	119-12-0	Pyridiphenthion		1				0									0					1	1					0
253	13593-03-8	Quinalphos		2				0								1	1					1	1					0
254	2797-51-5	Quinoclamine		1				0									0					1	1					0
255	148-24-3	Quinolin-8-ol; 8-hydroxyquinoline		1				0							1		1						0					0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
256	124495-18-7	Quinoxifen		1			0								0	1		1		1					0
257	119738-06-6	Quizalofop-p-tefuryl		1			0								1	1				0					0
258	10453-86-8	Resmethrin		2			0				1			1	1				1	1					0
259	83-79-4	Rotenone		1			0								0				1	1					0
260	105024-66-6	Silafluofen		2			0						1		1				1	1					0
261	143-33-9	Sodium cyanide		1		1	1								0					0					0
262	62-74-8	Sodium fluoroacetate (1080)		1	1		1								0					0					0
263	187166-15-0	Spinetoram		1			0								0				1	1					0
264	168316-95-8	Spinosad		1			0								0				1	1					0
265	148477-71-8	Spirodiclofen		1			0			1	1				1					0					0
266	57-24-9	Strychnine		1		1	1								0					0					0
267	4151-50-2	Sulfuramid		1			0								0					0		1		1*	1
268	3689-24-5	Sulfotep		1	1		1								0					0					0
269	946578-00-3	Sulfoxaflor		1			0								0				1	1					0
270	21564-17-0	TCMTB		1			1								0					0					0
271	96182-53-5	Tebupirimifos		2	1		1								0		1	1		1					0
272	79538-32-2	Tefluthrin		2		1	1								0					1	1				0

## PAN International List of Highly Hazardous Pesticides – March 2019

		Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity				Group 4 Conventions											
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PLC	See note below the table	POP	max = 1
273	3383-96-8	Temephos		1				0									0					1	1					0
274	149979-41-9	Tepaloxydim		1				0								1	1							0				0
275	13071-79-9	Terbufos		1	1			1									0							0				0
276	886-50-0	Terbutryn		1				0								1	1							0				0
277	2593-15-9	Terrazole; Etridiazole		1				0					1				1							0				0
278	22248-79-9	Tetrachlorvinphos		2				0					1				1					1	1					0
279	112281-77-3	Tetraconazole		1				0					1				1							0				0
280	7696-12-0	Tetramethrin		1				0									0					1	1					0
281	111988-49-9	Thiacloprid		1				0					1		1		1							0				0
282	153719-23-4	Thiamethoxam		1				0									0					1	1					0
283	59669-26-0	Thiodicarb		2				0					1				1					1	1					0
284	39196-18-4	Thiofanox		2		1		1									0					1	1					0
285	640-15-3	Thiometon		2		1		1									0					1	1					0
286	23564-05-8	Thiophanate-methyl		1				0					1				1							0				0
287	62-56-6	Thiourea		1				0								1	1							0				0
288	137-26-8	Thiram in formulations with benomyl and carbofuran		2				0								1	1							0	1	X		1
289	330459-31-9	Tioxazafen		1				0					1				1							0				0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity				Group 2: Long term effects							Group 3: Environmental toxicity					Group 4 Conventions					
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330 max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees max = 1	Montr Prot max = 1	PIC	See note below the table	POP	max = 1
290	129558-76-5	Tolfenpyrad		1			0								0	1			1						0
291	731-27-1	Tolyfluanid		2		1	1				1				1										0
292	66841-25-6	Tralomethrin		1			0								0				1	1					0
293	55219-65-3	Triadimenol		1			0						1		1										0
294	2303-17-5	Tri-allate		1			0								0		1	1			1				0
295	24017-47-8	Triazophos		1	1		1								0										0
296	for CAS number see list of grouped pesticides	Tributyltin compounds	x	2			0							1	1							1			1
297	52-68-6	Trichlorfon		3			0							1	1					1	1	1			1
298	81412-43-3	Tridemorph		1			0						1		1										0
299	99387-89-0	Triflumizole		1			0						1		1										0
300	1582-09-8	Trifluralin		2			0							1	1	1									0
301	37248-47-8	Validamycin		1			0								0					1	1				0
302	2275-23-2	Vamidothion		2	1		1								0					1	1				0
303	50471-44-8	Vinclozolin		1			0						1	1	1										0
304	81-81-2	Warfarin		2	1	1	1						1		1										0
305	2655-14-3	XMC		1			0								0					1	1				0

## PAN International List of Highly Hazardous Pesticides – March 2019

				Group 1: Acute Toxicity			Group 2: Long term effects							Group 3: Environmental toxicity				Group 4 Conventions										
	CAS number	Pesticide	Grouped (see page 21)	Sum of max=1 in Groups 1-4	WHO Ia	WHO Ib	H330	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA prob likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	very bio acc	sediment	very pers water, soil or	very toxic to aq. organism	highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
					306	52315-07-8z	zeta-Cypermethrin		2		1		1									0					1	1
307	1314-84-7	Zinc phosphide		1		1		1									0						0					0
308	12122-67-7	Zineb		1				0							1	1	1						0					0
309	137-30-4	Ziram		1			1	1									0						0					0
310	23783-98-4	Z-Phosphamidon		0	1			0									0						0					0

X: Annex III of the Rotterdam Convention includes certain specific formulations.

CF: Formulations at or above the specified concentration have been agreed by the Rotterdam COP to meet the criteria for listing, but are not yet formally listed

C<sub>PIC</sub>: agreed by the PIC Convention's Chemical Review Committee and the Conference of the Parties as meeting the criteria of the Convention but yet not formally listed

C<sub>POP</sub>: agreed by the POPs Chemical Review Committee and the Conference of the Parties as meeting the criteria of the Stockholm Convention but yet not formally listed

\* Although sulfluramid is not specially listed under the Stockholm Convention it is regarded by the Stockholm COP as being listed because it is derived from and breaks down into substances that are listed (PFOS and salts).