PAN International List of Highly Hazardous Pesticides

(PAN List of HHPs)

March 2021

Pesticide Action Network International

Impressum

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This 'PAN International List of Highly Hazardous Pesticides' is drafted by PAN Germany for PAN International. The 1st version was published January 2009. Since then criteria had been revised and the list has been updated several times.

Contents

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[1] 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. '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,[2] 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

[1] 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/)

[2] 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

range of activities envisaged within SAICM, the Council suggested that the activities of FAO 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)[3] 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.[4]

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*."[5]

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

[3] 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

[4] 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

[5] 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 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
- 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.[6]

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 and because FAO and WHO didn't come up with an HHP-List, 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 [7] where HHPs where formally recognised as an Issue of Concern (IoC) under SAICM and stakeholders were encouraged to take concerted action on them.[8]

2013-2021: 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

[6] 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/

[7] 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

[8] UNEP. Report of the International Conference on Chemicals Management on the work of its fourth session. Geneva: United Nations Environment Programme; 2015. Report No.: SAICM/ICCM.4/15. Available from: http://www.saicm.org/Portals/12/documents/meetings/ICCM4/doc/K1606013_e.pdf

FAO and WHO in 2013) and in the Guidelines on Highly Hazardous Pesticides, adopted in 2016[9]) 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 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)."*

In September 2020, UNEP published an *Assessment Report on Issues of Concern*,[10] in response to Resolution 4/8 by the United Nations Environment Assembly (UNEA). This report acknowledged that current instruments do not comprehensively address the sound management of HHPs at a global scale and that concerted international actions on HHPs are urgently needed and require for example, an international framework of sound management of Highly Hazardous Pesticides, possibly legally binding, and more engagement in alternative techniques that minimise chemical use~~s~~, such as agroecological techniques and integrated pest management.

In late 2020, FAO issued a draft Global Action Plan on HHPs, again acknowledging international concern and proposing a goal of the phase-out of HHPS from agriculture by 2030.

In January 2021 UNEP issued an advance draft "Summary for Policy Makers" of its report on pesticides and fertilisers for UNEA[11]. Key findings included, that "progress has been made in strengthening management of pesticides and fertilizers, including through international agreements. However, these agreements have not been sufficient to address all adverse environmental and health impacts comprehensively". The report recommends to: "Fundamentally change crop management and adopt ecosystem-based approaches" and lists among as a priority actions to strengthen pesticide management "Minimize or eliminate the risks posed by Highly Hazardous Pesticides".

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

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[9] 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/

[10] UNEP. 2020. An Assessment Report on Issues of Concern

[11] UNEP (2021): Environmental and health impacts of pesticides and fertilizers and ways of minimizing them. Summary for Policymakers(Advance Draft version 22Jan 2021) https://wedocs.unep.org/handle/20.500.11822/33807https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/34463/JSUNEPPF.pdf?sequence=3

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.

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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. Since then the additional PAN criteria for identifying HHPs have been revised several times and several updates of the list have been published. Relevant changes compared to the previous list are explained in the section *'What is new in this list?'*

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. It does not include those used as disinfectants, or internal human or veterinary medicines. It includes pesticides mainly used in agriculture, forestry, and gardening (e.g. insecticides, herbicides, fungicides, plant growth regulators and fumigants). Some of the substances are also used in aquaculture or on livestock to control ectoparasites, in homes and buildings, during transport, and in various materials and other products such as paint - to control insects, rodents, algae, and fungi. The list 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). It excludes: synergists, safeners, adjuvants and other additives in formulated pesticide products; and all the break-down products (metabolites) of pesticide active ingredients.

Basis

The PAN HHP list is currently based only on classifications by recognised authorities. It is created by compiling information from International bodies (WHO), the European (EU Commission), national agencies (USA EPA, Japan), 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. 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 March 2021 version serves as an update triggered by new evaluations. In addition, the following changes regarding the set of criteria have been made: in order to reflect the international nature of this list, we included Japan's as well as the EU's GHS classifications for identifying long term health effects. Regarding the identification of endocrine disrupting pesticides, the outdated EU priority list from 2004 is no longer used as a reference; instead, pesticides confirmed by the EU as endocrine disrupters according to the new Commission Regulation (EU) 2018/605 are included in addition to the still used interim criteria on endocrine disrupting properties laid down in Reg. (EC) No 1107/2009. Additionally, pesticides that are "likely to be carcinogenic to humans at high doses" according to EPA are included.

Compared to the previous version of the HHP list from March 2019 the following changes occurred:

The following pesticides are no longer on the list:

1. 2,4-DB
2. Atrazine
3. Hydrogen cyanamide
4. Fenarimol
5. Ioxynil
6. Picloram
7. Terbutryn
8. Zineb

The following pesticides have been added to the list:

1. 2,4-D
2. Acifluorfen, sodium
3. Biphenyl, Diphenyl
4. Bromophos-ethyl
5. Captan
6. Chlorpropham
7. Cholecalciferol
8. Cyanazine
9. Demeton-methyl (isomere mix of O-methyl and S-methyl)
10. Dichlobenil
11. Dichlorprop
12. Dodine
13. Ethion
14. Fenbuconazole
15. Fenhexamid
16. Ferbam
17. Fluazinam
18. Flusulfamide
19. Fluvalinate

20. Forchlorfenuron
21. Furfural
22. Halosulfuron-methyl
23. Imazalil sulfate
24. Lactofen
25. Mecoprop, MCPP
26. Meptyldinocap
27. Pyrethrins, Pyrethrum extract
28. Pyrimidifen
29. Simazine
30. Tau-fluvalinate
31. Tebuconazole
32. Thiabendazole
33. Tribufos, Tribuphos
34. Trichloracetic acid

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).[12]

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.

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!

[12] www.who.int/ipcs/poisons/pss.pdf

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:
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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.

High acute toxicity
'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 EU or the Japan Globally Harmonized System (GHS) or
Long term toxic effects
Carcinogenic to humans according to IARC or US EPA or
'Known or presumed human carcinogens' (Category I) according to the EU or the Japan Globally Harmonized System (GHS) or
Probable/likely carcinogenic to humans according to IARC, US EPA or
Likely to be Carcinogenic to Humans: At High Doses according to 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 EU or the Japan Globally Harmonized System (GHS) or
'Known or Presumed human reproductive toxicant' (Category I) according to the EU or the Japan Globally Harmonized System (GHS) or
Endocrine disruptor
EU interim criteria as laid down in Reg. (EC) No 1107/2009 'Suspected human reproductive toxicant' (Category 2) *AND* 'Suspected human carcinogen' (Category 2) according to the EU or the Japan Globally Harmonized System (GHS) or
Pesticides identified as endocrine disrupters in the EU according to Reg. (EU) 2018/605
High environmental concern
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
High environmental concern – where <u>two</u> of the three following criteria are met:

P = '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) *AND/OR*
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) *AND/OR*
T = Very toxic to aquatic organisms (LC/EC 50 [48h] for Daphnia spp. < 0,1 mg/l)
Hazard to ecosystem services
'Highly toxic for bees' according to U.S. EPA (LD50, µg/bee < 2) or
Known to cause a high incidence of severe or irreversible adverse effects
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 GHS List", laid down in EU Regulation 1272/2008/EC on classification, labelling and packaging of substances and mixtures (so called "CLP-Regulation") which entered into force in January 2009 and which implements the GHS in the Europe Union. A pesticide with its specific classification[13] is also added to the HHP list, in case the pesticide was excluded from EU authorization because it qualifies as Carc 1, Muta 1 or Repr 1, but is not yet listed as such in EU Regulation 1272/2008/EC. This is in line with the approval criteria ("exclusion criteria") laid down in the EU Pesticide Regulation 1107/2009 Annex II. The reason for this is: The EU Regulation 1272/2008/EC considerably lacks behind other EU legislation. It can take several years that a confirmed classification officially enters the relevant EU GHS regulation, while decision documents (regulation) of non-approved pesticides already refer to the new classification.

And – with this new 2021 update - PAN also includes the GHS Japan list as an additional source for the identification of HHPs. Both lists are used to identify pesticides which are considered highly toxic via inhalation, carcinogenic, mutagenic and/or toxic to reproduction.

Sources used:

[13] In case the pesticide is already on the HHP list

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.

Decision documents (regulation) of non-approval for individual active ingredients

GHS classification by the Japanese Government (2020):
https://www.nite.go.jp/chem/english/ghs/ghs_download.html

The WHO Recommended Classification of Pesticides by Hazard

The latest revision of the WHO Recommended Classification of Pesticides by Hazards was conducted in 2019. 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[14]). 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).
- LD_{50} 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_{50} values of the active ingredients in the formulation or mixture. However, so-called 'inert' ingredients or solvents[15] are neglected in this calculation although they may have an influence on the toxicity of the formulation or the mixture.

Source used:

WHO (2019): WHO recommended classification of pesticides by hazard and guidelines to classification, 2019 edition. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0IGO.

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.

[14] 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

[15] "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.

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[16], based on pesticides registered in the U.S.A. The list is updated annually; it list is a product of the general risk assessment included in the process of pesticide registration. This classification includes the potential exposure of humans[17]. 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. With the 2021 update, PAN agreed on adding those pesticides to the HHP list that are likely to be carcinogenic to humans “at high doses” according to EPA.

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[18]. US EPA defines a pesticide as highly toxic to bees if the LD_{50} 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. However, the process of agreeing on criteria for their identification has been very slow. We are still waiting for officially lists of pesticides with confirmed endocrine disrupting properties. 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. But

[16] 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

[17] 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

[18] 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

only in 2018 the EU adopted a set of criteria laid down in the Reg. 2018/605[19] and technical guidelines to identify endocrine disruptive pesticides. This identification will be done step by step within the process of pesticide authorisation. In 2020 the first pesticide that was officially identified as an endocrine disruptive pesticide was mancozeb. It will take some years to identify which other pesticides currently on the EU market are "endocrine disrupters" (ED) according to the agreed criteria. Until there is a comprehensive 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 GHS classifications of carcinogenic category 2 *AND* toxic for reproduction category 2. In doing so, PAN uses both the Japan and EU GHS classifications. Knowing that this approach is not ideal, we will follow approaches to identify ED pesticides from other regions and agencies and consider integrating them in this List in the future.

Sources used:

EC (2008-2020): 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

EC (2018): Regulation 2018/605 of 19 April 2018 amending Annex II to Regulation (EC) No 1107/2009 by setting out scientific criteria for the determination of endocrine disrupting properties

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

[19] Commission Regulation (EU) 2018/605 of 19 April 2018 amending Annex II to Regulation (EC) No 1107/2009 by setting out scientific criteria for the determination of endocrine disrupting properties https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018R0605

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.[20] 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[21] 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 (2020): 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

[20] https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-0
[21] 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). The update of the WHO recommendation for Classification of Pesticides by Hazards in 2019 and changes in identifying obsolete pesticides, PAN's decision to include Japan's GHS classification, changes to the criteria for identifying endocrine disruptors, and the expansion of an existing criterion for carcinogenic pesticides (see details under *What is new in this List*), induced changes again for this 2021 update.

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

2009-2011

Alanycarb
Amidosulfuron
Asulam, sodium salt
Benfuracarb
Bensulide
beta-HCH; beta-BCH
Bioresmethrin
Blasticidin-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
Fenchlorazole-ethyl
Fenothiocarb
Fenpropidin
Flufenoxuron
Glufosinate-ammonium
Lenacil
Metazachlor
Metobromuron
Metoxuron
Metsulfuron-methyl
Milbemectin
Naled
Napropamide
Nicosulfuron
Nitenpyram
Nitrobenzene
Oxycarboxin
Penconazole
Pentachlorbenzene
Pirimiphos-methyl
Prallethrin
Profenofos
Pyraclofos

Pyrazophos
Pyridaben
Pyridiphenthion
Pyrifenox
Quinmerac
Rotenone
Silafluofen
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
Sulfluramide
Triadimenol

Since March 2018

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

Since March 2019

2,4-D
Acifluorfen, sodium
Biphenyl, Diphenyl
Bromophos-ethyl
Captan
Chlorpropham
Cholecalciferol
Cyanazine
Demeton-methyl
Dichlobenil
Dichlorprop
Diphenyl/biphenyl
Dodine
Ethion
Fenbuconazole
Fenhexamid
Ferbam
Fluazinam
Flusulfamide
Fluvalinate
Forchlorfenuron
Furfural
Halosulfuron-methyl
Imazalil sulfate
Lactofen
Mecoprop, MCPP
Meptyldinocap
Pyrethrins, Pyrethrum extract
Pyrimidifen
Simazine
Tau-fluvalinate
Tebuconazole
Thiabendazole
Tribufos, Tribuphos
Trichloracetic acid

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, isooctyl 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
Chlozolinate
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
Ethalfluralin
Ethiozin
Ethiprole
Ethofumesate
Fenbuconazole
Fenpropidin
Flonicamid
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
Pyrifenox
Pyrimethanil
Pyrithiobac-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
Triflusulfuron-methyl
Triforine
Triticonazole
Uniconazole

Since June 2014

Fluopyram

Since June 2015

Imazethapyr

Since December 2016

MGK 326

Since March 2018

Cyflufenamid
Sedaxane
Nitrapyrin
Sodium dimethyl dithio carbamate
Propyzamide

Since March 2019

2,4-DB
Atrazine
Hydrogen cyanamide
Fenarimol
Ioxynil
Picloram
Terbutryn
Zineb

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	'*Fatal if inhaled'*, hazard classification according to the EU or Japan 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
GHS^+ carc (1A, 1B)	Known or presumed human carcinogens (1A or 1B) according to EU or Japan GHS
EPA prob/likel carc	Probable/ Likely carcinogen (including "Likely to be Carcinogenic to Humans: At High Doses" according to EPA
IARC prob carc	Probable carcinogen according to IARC
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 or Japan GHS.
GHS^+ repro (1A, 1B)	Known or presumed human reproductive toxicant according to EU or Japan GHS.
GHS^+ C2 & R2	Pesticides classified GHS Carcinogen Category 2 AND Reproductive Category 2 following EU or Japan GHS
EU ED	Known as an endocrine disrupter according to EU assessment following Commission Regulation (EU) 2018/605
Very bio acc	Very bioaccumulative (BCF >5000) or Kow logP >5 (BCF values supersede Kow logP data)
Very pers 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
Arsenic and its coumpounds	
Arsenic pentoxide	1303-28-2
Arsenic pentoxide hydrate	12044-50-7
Arsenic trioxide	1327-53-3
Cacolydate; sodium dimethylarsinate	124-65-2
Calcium arsenate	7778-44-1
Chromated copper arsenate; CCA	75-60-5
Copper arsenate	7778-41-8
DSMA; Disodium methanearsonate	144-21-8
Lead arsenate	7784-40-9
MAA, methylarsonic acid	124-58-3
MSMA	2163-80-6
MSMA, calcium salt	5902-95-4
Paris Green	12002-03-8
Sodium arsenate	13464-38-5
Sodium arsenite	7784-46-5
Borax; Borate salts	
Borax, disodium octaborate anhydrous	12008-41-2
Borax, disodium octaborate tetrahydrate	12280-03-4
Borax, disodium tetraborate decahydrate	1303-96-4
DNOC and its salts	
DNOC, ammonium salt	2980-64-5
DNOC, potassium salt	5787-96-2
DNOC, sodium salt	2312-76-7
DNOC	534-52-1
Glyphosate and its salts	
Glyphosate (acid)	1071-83-6
Glyphosate-diammonium	69254-40-6
Glyphosate-isopropylamine (-isopropylammonium;-IPA)	38641-94-0
Glyphosate-monoammonium	40465-66-5
Glyphosate-sodium	34494-03-6
Glyphosate-trimesium	81591-81-3
Mercury and its compounds	
2-Acetoxymercuricethanol phenylmercuric lactate	4665-55-8
Chloromethoxypropylmercuric acetate; CPMA	1319-86-4

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

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

PAN International List of Highly Hazardous Pesticides – March 2021

					Group 1: Acute Toxicity				Group 2: Long term effects										Group 3: Environmental toxicity					Group 4: Conventions				
	CAS number	**Pesticide**	Grouped (see page 23)	**Sum of max=1 in Groups 1-4**	WHO Ia	WHO Ib	H330	**max = 1**	EPA carc	IARC carc	GHS+ carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS+ muta (1A, 1B)	GHS+ repro (1A ,1B)	EU EDC	GHS+ C2 & R2	**max = 1**	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
0					**30**	**52**	**63**	**118**	**1**	**4**	**14**	**8**	**77**	**5**	**42**	**1**	**59**	**159**	**22**	**18**	**30**	**118**	**150**	**1**	**31**	**0**	**10**	**36**
1	542-75-6	1,3-dichloropropene		**1**				**0**					1					**1**					**0**					**0**
2	94-75-7	2,4-D		**1**				**0**									1	**1**					**0**					**0**
3	71751-41-2	Abamectin		**2**		1	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	62476-59-9	Acifluorfen, sodium		**1**				**0**					*1*					**1**					**0**					**0**
7	101007-06-1	Acrinathrin		**1**				**0**										**0**				1	**1**					**0**
8	107-02-8	Acrolein		**1**		1	1	**1**										**0**					**0**					**0**
9	15972-60-8	Alachlor		**2**				**0**					*1*				1	**1**					**0**		1			**1**
10	83130-01-2	Alanycarb		**1**				**0**										**0**				1	**1**					**0**
11	116-06-3	Aldicarb		**3**	1		1	**1**										**0**				1	**1**		1			**1**
12	319-84-6; 319-85-7	alpha-BHC; alpha-HCH		**1**				**0**										**0**					**0**				1	**1**
13	96-24-2	Alpha-chlorohydrin		**1**		1		**1**										**0**					**0**					**0**
14	20859-73-8	Aluminum phosphide		**2**			1	**1**										**0**				1	**1**					**0**
15	348635-87-0	Amisulbrom		**1**				**0**										**0**		1	1		**1**					**0**

PAN International List of Highly Hazardous Pesticides – March 2021

					Group 1: Acute Toxicity				Group 2: Long term effects										Group 3: Environmental toxicity					Group 4: Conventions				
	CAS number	**Pesticide**	Grouped (see page 23)	**Sum of max=1 in Groups 1-4**	WHO Ia	WHO Ib	H330	**max = 1**	EPA carc	IARC carc	GHS+ carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS+ muta (1A, 1B)	GHS+ repro (1A ,1B)	EU EDC	GHS+ C2 & R2	**max = 1**	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
16	61-82-5	Amitrole		1				0									1	1					0					0
17	90640-80-5	Anthracene oil		1				0			1							1					0					0
18	84-65-1	Anthraquinone		1				0					1		1			1					0					0
19	7778-39-4	Arsen and its compounds	x	1				0	1	1	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	1820573-27-0	Beta-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

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					Group 1: Acute Toxicity				Group 2: Long term effects										Group 3: Environmental toxicity					Group 4: Conventions				
	CAS number	**Pesticide**	Grouped (see page 23)	**Sum of max=1 in Groups 1-4**	WHO Ia	WHO Ib	H330	**max = 1**	EPA carc	IARC carc	GHS+ carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS+ muta (1A, 1B)	GHS+ repro (1A ,1B)	EU EDC	GHS+ C2 & R2	**max = 1**	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
33	28434-01-7	Bioresmethrin		2				0							1			1				1	1					0
34	92-52-4	Biphenyl; Diphenyl		1				0			1							1					0					0
35	2079-00-7	Blasticidin-S		1		1		1										0					0					0
36	1303-96-4	Borax; Borate salts	x	1				0							1			1					0					0
37	10043-35-3	Boric acid		1				0							1		1	1					0					0
38	56073-10-0	Brodifacoum		2	1		1	1							1			1					0					0
39	28772-56-7	Bromadiolone		2	1		1	1							1			1					0					0
40	63333-35-7	Bromethalin		2	1			1										0	1		1		1					0
41	4824-78-6	Bromophos-ethyl		1		1		1										0					0					0
42	1689-84-5	Bromoxynil		2			1	1							1			1					0					0
43	56634-95-8	Bromoxynil heptanoate		2				0							1			1	1		1		1					0
44	1689-99-2	Bromoxynil octanoate		2				0							1			1	1		1		1					0
45	23184-66-9	Butachlor		1				0					1					1					0					0
46	34681-10-2	Butocarboxim		2		1		0										0				1	1					0
47	34681-23-7	Butoxycarboxim		1		1		1										0					0					0
48	95465-99-9	Cadusafos		2		1		1										0		1	1	1	1					0
49	592-01-8	Calcium cyanide		1	1			1										0					0					0

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	CAS number	**Pesticide**	Grouped (see page 23)	**Sum of max=1 in Groups 1-4**	WHO Ia	WHO Ib	H330	**max = 1**	EPA carc	IARC carc	GHS+ carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS+ muta (1A, 1B)	GHS+ repro (1A ,1B)	EU EDC	GHS+ C2 & R2	**max = 1**	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
50	2425-06-1	Captafol		**3**	1			**1**			1	1	1					**1**					**0**		1			**1**
51	133-06-2	Captan		**1**				**0**					*1*				1	**1**					**0**					**0**
52	63-25-2	Carbaryl		**2**				**0**					1				1	**1**				1	**1**					**0**
53	10605-21-7	Carbendazim		**1**				**0**						1	1			**1**					**0**					**0**
54	16118-49-3	Carbetamide		**1**				**0**							1			**1**					**0**					**0**
55	1563-66-2	Carbofuran		**3**		1	1	**1**										**0**				1	**1**		1	X		**1**
56	55285-14-8	Carbosulfan		**3**			1	**1**										**0**				1	**1**		1	C_{PIC}		**1**
57	2439-01-2	Chinomethionat; Oxythioquinox		**1**				**0**					1					**1**					**0**					**0**
58	500008-45-7	Chlorantraniliprole		**1**				**0**										**0**		1	1		**1**					**0**
59	57-74-9	Chlordane		**3**				**0**					1				1	**1**	1				**1**		1		1	**1**
60	54593-83-8	Chlorethoxyphos		**2**	1			**1**										**0**				1	**1**					**0**
61	122453-73-0	Chlorfenapyr		**1**				**0**										**0**				1	**1**					**0**
62	470-90-6	Chlorfenvinphos		**2**		1		**1**										**0**				1	**1**					**0**
63	71422-67-8	Chlorfluazuron		**1**				**0**										**0**	1		1		**1**					**0**
64	24934-91-6	Chlormephos		**1**	1			**1**										**0**					**0**					**0**
65	67-66-3	Chloroform		**1**				**0**					1					**1**					**0**					**0**
66	3691-35-8	Chlorophacinone		**1**	1			**1**										**0**					**0**					**0**

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	CAS number	**Pesticide**	Grouped (see page 23)	**Sum of max=1 in Groups 1-4**	WHO Ia	WHO Ib	H330	**max = 1**	EPA carc	IARC carc	GHS^{+} carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS^{+} muta (1A, 1B)	GHS^{+} repro (1A ,1B)	EU EDC	GHS^{+} C2 & R2	**max = 1**	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
67	120-32-1	Chlorophene; 2-benzyl-4-chlorophenol		1				0									1	1					0					0
68	76-06-2	Chloropicrin		1			1	1										0					0					0
69	1897-45-6	Chlorothalonil		2			1	1					1					1					0					0
70	15545-48-9	Chlorotoluron		1				0									1	1					0					0
71	101-21-3	Chlorpropham		1				0									1	1					0					0
72	2921-88-2	Chlorpyrifos		2				0							1			1				1	1					0
73	5598-13-0	Chlorpyrifos-methyl		2				0							1			1				1	1					0
74	67-97-0	Cholecalciferol		1				0							1			1					0					0
75	38083-17-9	Climbazole		1				0										0				1	1					0
76	210880-92-5	Clothianidin		1				0										0				1	1					0
77	20427-59-2	Copper (II) hydroxide		2			1	1										0		1	1		1					0
78	56-72-4	Coumaphos		2		1	1	1							1			1					0					0
79	5836-29-3	Coumatetralyl		1		1	1	1							1			0					0					0
80	8001-58-9	Creosote		1				0			1	1	1					1					0					0
81	420-04-2	Cyanamide		1				0									1	1					0					0
82	21725-46-2	Cyanazine		1				0									1	1					0					0
83	68359-37-5	Cyfluthrin		2		1	1	1										0				1	1					0

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84	68085-85-8	Cyhalothrin		1				0										0				1	1					0
85	76703-62-3	Cyhalothrin, gamma		1				0										0				1	1					0
86	13121-70-5	Cyhexatin		1				0										0	1		1		1					0
87	52315-07-8	Cypermethrin		1				0										0				1	1					0
88	67375-30-8	Cypermethrin, alpha		1				0										0				1	1					0
89	65731-84-2	Cypermethrin, beta		1				0										0				1	1					0
90	94361-06-5	Cyproconazole		1				0							1			1					0					0
91	1596-84-5	Daminozide		1				0					1					1					0					0
92	50-29-3	DDT		3				0				1	1				1	1		1	1		1		1		1	1
93	52918-63-5	Deltamethrin		2				0									1	1				1	1					0
94	8022-00-2	Demeton-methyl (isomere mix of O-methyl and S-methyl)		1			1	1										0					0					0
95	919-86-8	Demeton-S-methyl		2		1		1										0				1	1					0
96	80060-09-9	Diafenthiuron		1				0										0				1	1					0
97	333-41-5	Diazinon		2				0				1						1				1	1					0
98	1194-65-6	Dichlobenil		1				0									1	1					0					0
99	120-36-5	Dichlorprop		1				0							1			1					0					0

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100	62-73-7	Dichlorvos; DDVP		2		1	1	1										0				1	1					0
101	51338-27-3	Diclofop-methyl		1				0					1					1					0					0
102	115-32-2	Dicofol		1				0										0					0			C_{POP}	1	1
103	141-66-2	Dicrotophos		2		1		1										0				1	1					0
104	56073-07-5	Difenacoum		2	1			1										0	1				1					0
105	104653-34-1	Difethialone		2	1		1	1							1			1					0					0
106	60-51-5	Dimethoate		1				0										0				1	1					0
107	149961-52-4	Dimoxystrobin		2				0									1	1		1	1		1					0
108	39300-45-3	Dinocap		1				0							1			1					0					0
109	165252-70-0	Dinotefuran		1				0										0				1	1					0
110	1420-07-1	Dinoterb		2		1		1							1			1					0					0
111	82-66-6	Diphacinone		1	1			1										0					0					0
112	85-00-7	Diquat dibromide		1			1	1										0					0					0
113	4032-26-2	Diquat dichloride		1			1	1										0					0					0
114	298-04-4	Disulfoton		1	1			1										0					0					0
115	330-54-1	Diuron		1				0					1					1					0					0
116	534-52-1	DNOC and its salts	x	2		1	1	1										0					0		1			1

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117	2439-10-3	Dodine		1			1	1										0					0					0
118	17109-49-8	Edifenphos		1		1		1										0					0					0
119	155569-91-8	Emamectin benzoate		1				0										0		1	1	1	1					0
120	115-29-7	Endosulfan		2			1	1										0					0		1		1	1
121	297-99-4	E-Phosphamidon		1	1			1										0					0					0
122	106-89-8	Epichlorohydrin		1				0			1	1	1				1	1					0					0
123	2104-64-5	EPN		2	1			1										0				1	1					0
124	133855-98-8	Epoxiconazole		1				0					1		1		1	1					0					0
125	66230-04-4	Esfenvalerate		1				0										0				1	1					0
126	29973-13-5	Ethiofencarb		1		1		1										0					0					0
127	563-12-2	Ethion		1			1	1										0					0					0
128	23947-60-6	Ethirimol		1				0										0				1	1					0
129	13194-48-4	Ethoprophos; Ethoprop		2	1		1	1					1					1					0					0
130	106-93-4	Ethylene dibromide; 1,2-dibromoethane		2				0			1	1	1				1	1					0		1			1
131	107-06-2	Ethylene dichloride; 1,2-Dichloroethane		2				0			1		1					1					0		1			1
132	75-21-8	Ethylene oxide		2				0		1	1			1	1			1					0		1			1

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133	96-45-7	Ethylene thiourea		1				0					1		1		1	1					0					0
134	80844-07-1	Etofenprox; Ethofenprox		1				0										0		1	1	1	1					0
135	52-85-7	Famphur		1		1		1										0					0					0
136	22224-92-6	Fenamiphos		2		1	1	1										0				1	1					0
137	120928-09-8	Fenazaquin		1				0										0				1	1					0
138	114369-43-6	Fenbuconazole		1				0									1	1					0					0
139	13356-08-6	Fenbutatin-oxide		2			1	1										0		1	1		1					0
140	103112-35-2	Fenchlorazole-ethyl		1				0			1							1					0					0
141	126833-17-8	Fenhexamid		1			1	1										0					0					0
142	122-14-5	Fenitrothion		2				0									1	1				1	1					0
143	72490-01-8	Fenoxycarb		2				0					1					1				1	1					0
144	39515-41-8	Fenpropathrin		2			1	1										0				1	1					0
145	134098-61-6	Fenpyroximate		1			1	1										0					0					0
146	55-38-9	Fenthion / Fenthion > 640g/L		2				0										0				1	1		1	CF		1
147	900-95-8	Fentin acetate; Triphenyltin acetate		2			1	1									1	1					0					0
148	76-87-9	Fentin hydroxide; Triphenyltin hydroxide		2			1	1					1				1	1					0					0

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149	51630-58-1	Fenvalerate		1				0										0				1	1					0
150	14484-64-1	Ferbam		1			1	1										0					0					0
151	120068-37-3	Fipronil		1				0										0				1	1					0
152	90035-08-8	Flocoumafen		2	1		1	1							1			1					0					0
153	69806-50-4	Fluazifop-butyl		1				0							1			1					0					0
154	79622-59-6	Fluazinam		1			1	1										0					0					0
155	174514-07-9	Fluazolate		1				0										0	1		1		1					0
156	272451-65-7	Flubendiamide		1				0										0		1	1		1					0
157	70124-77-5	Flucythrinate		2		1		1										0				1	1					0
158	101463-69-8	Flufenoxuron		1				0										0	1		1		1					0
159	62924-70-3	Flumetralin		1				0										0	1		1		1					0
160	103361-09-7	Flumioxazin		1				0							1			1					0					0
161	640-19-7	Fluoroacetamide		2		1		1										0					0		1			1
162	951659-40-8	Flupyradifurone		1				0										0				1	1					0
163	85509-19-9	Flusilazole		1				0							1			1					0					0
164	106917-52-6	Flusulfamide		1			1	1										0					0					0
165	117337-19-6	Fluthiacet-methyl		1				0					1					1					0					0

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166	69409-94-5	Fluvalinate		1			1	1										0					0					0
167	133-07-3	Folpet		2			1	1									1	1					0					0
168	68157-60-8	Forchlorfenuron		1				0									1	1					0					0
169	50-00-0	Formaldehyde		1				0		1			1					1					0					0
170	22259-30-9	Formetanate		2		1	1	1										0				1	1					0
171	98886-44-3	Fosthiazate		1				0										0				1	1					0
172	65907-30-4	Furathiocarb		1		1	1	1										0					0					0
173	98-01-1	Furfural		1				0					*1*					1					0					0
174	121776-33-8	Furilazole		1				0					1					1					0					0
175	77182-82-2	Glufosinate-ammonium		1				0							1			1					0					0
176	1071-83-6	Glyphosate	x	1				0				1						1					0					0
177	111872-58-3	Halfenprox		1				0										0	1		1		1					0
178	100784-20-1	Halosulfuron-methyl		1				0						1				1					0					0
179	69806-40-2	Haloxyfop-methyl (unstated stereochemistry)		1				0					1					1					0					0
180	23560-59-0	Heptenophos		2		1		1										0				1	1					0
181	118-74-1	hexachlorobenzene / benzene hexachloride (HCB/BHC)		4	1			1			1		1				1	1	1				1		1		1	1

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	CAS number	**Pesticide**	Grouped (see page 23)	**Sum of max=1 in Groups 1-4**	WHO Ia	WHO Ib	H330	**max = 1**	EPA carc	IARC carc	GHS+ carc (1A, 1B)	IARC prob carc	EPA prob likel carc	GHS+ muta (1A, 1B)	GHS+ repro (1A ,1B)	EU EDC	GHS+ C2 & R2	**max = 1**	very bio acc	very pers water, soil or sediment	very toxic to aq. organism	highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
182	86479-06-3	Hexaflumuron		1				0										0				1	1					0
183	608-73-1	Hexchlorocyclohexane; mix of isomers (beta-HCH & alpha-HCH)		2				0					1				1	1					0		1			1
184	78587-05-0	Hexythiazox		1				0					1					1					0					0
185	74-90-8	Hydrogen cyanide**		1	1		1	1										0										0
186	35554-44-0	Imazalil		1				0					1					1					0					0
187	58594-72-2	Imazalil sulfate		1				0					1					1					0					0
188	138261-41-3	Imidacloprid		1				0										0				1	1					0
189	72963-72-5	Imiprothrin		1				0										0				1	1					0
190	173584-44-6	Indoxacarb		1				0										0				1	1					0
191	36734-19-7	Iprodione		1				0					1					1					0					0
192	140923-17-7	Iprovalicarb		1				0					1					1					0					0
193	881685-58-1	Isopyrazam		2				0					1					1		1	1		1					0
194	141112-29-0	Isoxaflutole		1				0					1					1					0					0
195	18854-01-8	Isoxathion		2		1		1										0				1	1					0
196	143390-89-0	Kresoxim-methyl		1				0					1					1					0					0
197	77501-63-4	Lactofen		1				0					*1*					1					0					0

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198	91465-08-6	Lambda-cyhalothrin		3			1	**1**									1	**1**				1	**1**					**0**
199	58-89-9	Lindane		3				**0**		1							1	**1**				1	**1**		1		1	**1**
200	330-55-2	Linuron		1				**0**							1		1	**1**					**0**					**0**
201	103055-07-8	Lufenuron		1				**0**										**0**	1	1	1		**1**					**0**
202	12057-74-8	Magnesium phosphide		1			1	**1**										**0**					**0**					**0**
203	121-75-5	Malathion		2				**0**				1						**1**				1	**1**					**0**
204	8018-01-7	Mancozeb		1				**0**					1		1	1	1	**1**					**0**					**0**
205	12427-38-2	Maneb		1				**0**					1				1	**1**					**0**					**0**
206	2595-54-2	Mecarbam		1		1		**1**										**0**					**0**					**0**
207	7085-19-0	Mecoprop; MCPP		1				**0**									1	**1**					**0**					**0**
208	110235-47-7	Mepanipyrim		1				**0**					1					**1**					**0**					**0**
209	131-72-6	Meptyldinocap		1				**0**							1			**1**					**0**					**0**
210	7439-97-6	Mercury and its compounds	x	2			1	**1**										**0**					**0**		1			**1**
211	139968-49-3	Metaflumizone		1				**0**										**0**	1	1		1	**1**					**0**
212	137-41-7	Metam-potassium		1				**0**					1					**1**					**0**					**0**
213	137-42-8	Metam-sodium		1				**0**					1				1	**1**					**0**					**0**
214	18691-97-9	Methabenzthiazuron		1				**0**										**0**				1	**1**					**0**

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215	10265-92-6	Methamidophos		3		1	1	1										0				1	1		1	X		1
216	950-37-8	Methidathion		2		1		1										0				1	1					0
217	2032-65-7	Methiocarb		2		1		1										0				1	1					0
218	16752-77-5	Methomyl		2		1		1										0				1	1					0
219	72-43-5	Methoxychlor		1				0										0					0				1	1
220	74-83-9	Methyl bromide		1				0										0					0	1				1
221	9006-42-2	Metiram		1				0					1				1	1					0					0
222	21087-64-9	Metribuzin		1				0									1	1					0					0
223	7786-34-7	Mevinphos		2	1			1										0				1	1					0
224	51596-10-2	Milbemectin		1				0										0				1	1					0
225	2212-67-1	Molinate		1				0									1	1					0					0
226	71526-07-3	MON 4660; AD 67		1				0					1					1					0					0
227	6923-22-4	Monocrotophos		3		1	1	1										0				1	1		1			1
228	300-76-5	Naled		1				0										0				1	1					0
229	54-11-5	Nicotine		1		1	1	1										0					0					0
230	150824-47-8	Nitenpyram		1				0										0				1	1					0
231	98-95-3	Nitrobenzene		1				0							1		1	1					0					0

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232	121451-02-3	Noviflumuron		1				0					1					1					0					0
233	1113-02-6	Omethoate		3		1		1									1	1				1	1					0
234	19044-88-3	Oryzalin		1				0					1					1					0					0
235	19666-30-9	Oxadiazon		1				0					1					1					0					0
236	23135-22-0	Oxamyl		2	1		1	1										0				1	1					0
237	301-12-2	Oxydemeton-methyl		2		1		1										0				1	1					0
238	42874-03-3	Oxyfluorfen		1				0					1					1					0					0
239	64741-88-4	Paraffin oils; mineral oils	x	1				0			1							1					0					0
240	1910-42-5	Paraquat dichloride / Paraquat dichloride >276g/L		2			1	1										0					0		1	CF		1
241	56-38-2	Parathion		3	1			1										0				1	1		1			1
242	298-00-0	Parathion-methyl		2	1		1	1										0					0		1	X		1
243	87-86-5	PCP; Pentachlorphenol		3		1	1	1					1				1	1					0		1			1
244	40487-42-1	Pendimethalin		1				0										0	1	1			1					0
245	52645-53-1	Permethrin		2				0					1					1				1	1					0
246	2597-03-7	Phenthoate		1				0										0				1	1					0
247	298-02-2	Phorate		2	1			1										0				1	1					0

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248	732-11-6	Phosmet		1				0										0				1	1					0
249	13171-21-6	Phosphamidon		3	1			1										0				1	1		1	X		1
250	7803-51-2	Phosphine		1			1	1										0					0					0
251	23103-98-2	Pirimicarb		2				0					1					1		1	1		1					0
252	29232-93-7	Pirimiphos-methyl		1				0										0				1	1					0
253	299-45-6	Potasan		1			1	1										0					0					0
254	23031-36-9	Prallethrin		1				0										0				1	1					0
255	32809-16-8	Procymidone		1				0					1				1	1					0					0
256	41198-08-7	Profenofos		1				0										0				1	1					0
257	139001-49-3	Profoxydim		1				0									1	1					0					0
258	1918-16-7	Propachlor		1				0					1					1					0					0
259	2312-35-8	Propargite		2				0					1					1	1		1		1					0
260	31218-83-4	Propetamphos		1		1		1										0					0					0
261	60207-90-1	Propiconazole		1				0							1			1					0					0
262	12071-83-9	Propineb		1				0					1					1					0					0
263	114-26-1	Propoxur		2				0					1					1				1	1					0
264	75-56-9	Propylene oxide, Oxirane		1				0			1		1	1				1					0					0

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265	34643-46-4	Prothiofos		1				0										0	1		1		1					0
266	123312-89-0	Pymetrozine		1				0					1					1					0					0
267	77458-01-6	Pyraclofos		1				0										0				1	1					0
268	129630-19-9	Pyraflufen-ethyl		1				0					1					1					0					0
269	6814-58-0	Pyrazachlor		1				0					1					1					0					0
270	13457-18-6	Pyrazophos		1				0										0				1	1					0
271	108-34-9	Pyrazoxon		1			1	1										0					0					0
272	8003-34-7	Pyrethrins, Pyrethrum extract		1				0										0				1	1					0
273	96489-71-3	Pyridaben		1				0										0				1	1					0
274	179101-81-6	Pyridalyl		1				0										0	1	1	1		1					0
275	119-12-0	Pyridiphenthion		1				0										0				1	1					0
276	105779-78-0	Pyrimidifen		1			1	1										0					0					0
277	13593-03-8	Quinalphos		2				0									1	1				1	1					0
278	2797-51-5	Quinoclamine		1				0										0				1	1					0
279	148-24-3	Quinolin-8-ol; 8-hydroxyquinoline		1				0							1			1					0					0
280	124495-18-7	Quinoxyfen		1				0										0	1		1		1					0

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281	119738-06-6	Quizalofop-p-tefuryl		1				0									1	1					0					0
282	10453-86-8	Resmethrin		2				0					1				1	1				1	1					0
283	83-79-4	Rotenone		1				0										0				1	1					0
284	105024-66-6	Silafluofen		2				0							1			1				1	1					0
285	122-34-9	Simazine		1				0									1	1					0					0
286	143-33-9	Sodium cyanide		1		1		1										0					0					0
287	62-74-8	Sodium fluoroacetate (1080)		1	1		1	1										0					0					0
288	187166-15-0	Spinetoram		1				0										0				1	1					0
289	168316-95-8	Spinosad		1				0										0				1	1					0
290	148477-71-8	Spirodiclofen		1				0			1		1					1					0					0
291	57-24-9	Strychnine		1		1		1										0					0					0
292	4151-50-2	Sulfluramid		1				0										0					0		1		1*	1
293	3689-24-5	Sulfotep		1	1			1										0					0					0
294	946578-00-3	Sulfoxaflor		1				0										0				1	1					0
295	102851-06-9	Tau-fluvalinate		1			1	1										0					0					0
296	21564-17-0	TCMTB		1			1	1										0					0					0
297	107534-96-3	Tebuconazole		2			1	1									1	1					0					0

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298	96182-53-5	Tebupirimifos		2	1			1										0		1	1		1					0
299	79538-32-2	Tefluthrin		2		1	1	1										0				1	1					0
300	3383-96-8	Temephos		1				0										0				1	1					0
301	149979-41-9	Tepraloxydim		1				0									1	1					0					0
302	13071-79-9	Terbufos		1	1			1										0					0					0
303	2593-15-9	Terrazole; Etridiazole		1				0					1					1					0					0
304	22248-79-9	Tetrachlorvinphos		2				0					1					1				1	1					0
305	112281-77-3	Tetraconazole		1				0									1	1					0					0
306	7696-12-0	Tetramethrin		1				0										0				1	1					0
307	148-79-8	Thiabendazole		1				0					*1*		1			1					0					0
308	111988-49-9	Thiacloprid		1				0					1		1			1					0					0
309	153719-23-4	Thiamethoxam		1				0										0				1	1					0
310	59669-26-0	Thiodicarb		2				0					1					1				1	1					0
311	39196-18-4	Thiofanox		2		1		1										0				1	1					0
312	640-15-3	Thiometon		2		1		1										0				1	1					0
313	23564-05-8	Thiophanate-methyl		1				0					1					1					0					0
314	62-56-6	Thiourea		1				0									1	1					0					0

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315	137-26-8	Thiram in formulations with benomyl and carbofuran		1				0										0					0		1	X		1
316	330459-31-9	Tioxazafen		1				0					1					1					0					0
317	129558-76-5	Tolfenpyrad		1				0										0	1		1		1					0
318	731-27-1	Tolylfluanid		2			1	1					1					1					0					0
319	66841-25-6	Tralomethrin		1				0										0				1	1					0
320	55219-65-3	Triadimenol		1				0							1			1					0					0
321	2303-17-5	Tri-allate		1				0										0		1	1		1					0
322	24017-47-8	Triazophos		1		1		1										0					0					0
323	78-48-8	Tribufos, Tribuphos		1				0					*1*					1					0					0
324	nocas 8	Tributyltin compounds	x	2				0									1	1					0		1			1
325	52-68-6	Trichlorfon		3				0					*1*				1	1				1	1		1			1
326	76-03-9	Trichloroacetic acid		1				0									1	1					0					0
327	81412-43-3	Tridemorph		1				0							1			1					0					0
328	99387-89-0	Triflumizole		1				0							1			1					0					0
329	1582-09-8	Trifluralin		2				0									1	1	1				1					0
330	37248-47-8	Validamycin		1				0										0				1	1					0

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331	2275-23-2	Vamidothion		2		1		**1**										**0**				1	**1**					**0**
332	50471-44-8	Vinclozolin		1				**0**							1		1	**1**					**0**					**0**
333	81-81-2	Warfarin		2		1	1	**1**							1			**1**					**0**					**0**
334	2655-14-3	XMC		1				**0**										**0**				1	**1**					**0**
335	52315-07-8z	zeta-Cypermethrin		2		1		**1**										**0**				1	**1**					**0**
336	1314-84-7	Zinc phosphide		1		1		**1**										**0**					**0**					**0**
337	137-30-4	Ziram		1			1	**1**										**0**					**0**					**0**
338	23783-98-4	Z-Phosphamidon		1	1			**1**										**0**					**0**					**0**

GHS^{+}: This list uses the EU and the Japan GHS (Global Harmonized System) for identification of pesticides classified as GHS carc (1A, 1B), GHS muta (1A, 1B), GHS repro (1A ,1B) and C2 & R2

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 PIC: 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 POP: 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).

GHS (EU, Japan) C2 & R2: The combination-criterion GHS C2 & R2 was used by the EU as an interim criterion to indicate possible endocrine disrupting (ED) pesticides

EPA prob likel carc: Italic "*1*" stands for classified by EPA as "Likely to be Carcinogenic to Humans: At High Doses"

** This lists uses the same classification for hydrogen cyanide as for calcium cyanide. According to WHO (2019) Calcium cyanide reacts with moisture to produce hydrogen cyanide gas. Hydrogen cyanide is fatal if swallowed, in contact with skin or if inhaled. In liquid form this substance is also fatal if swallowed or in contact with skin.