PAN Germany

# Pesticides in Central and Eastern European Countries

## Usage, Registration, Identification and Evaluation

# Part 4: Slovenia

Hamburg, 2003

## Pesticide Action Network

Founded in 1982, Pesticide Action Network is an international coalition of over 400 citizen groups in more than 60 countries working to oppose the misuse of pesticides and to promote sustainable agriculture and ecologically sound pest management.

PAN Germany was founded in 1984 and strives to reduce impacts of pesticide use on national, european and international level.

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# 1 Introduction

Pesticide use in EU accession countries has been very low for over a decade, but is on the rise again. The accession of Slovenia into the European Union will most likely intensify agriculture. There is much fear that traditional ways of farming will be replaced by an industrial farming system with a high dependency on agrochemical usage with all its negative side effects.

In order to meet the challenges of the EU accession the capacities of Central and Eastern European NGOs need to be raised. NGOs need knowledge about pesticide hazards and the current discussion and activities regarding pesticide policy in the EU. For this purpose PAN Germany has started a CEEC project. This publication is one part of the project and aims at information dissemination on agriculture and pesticides to NGOs in Slovenia.

**PAN Germanys' Publications:**

*This brochure is one in a series of similar publications about pesticides in* ***Hungary, Poland, Slovenia*** *and the* ***Czech Republic.***

*These four publications focus on the evaluation of authorised pesticides regarding their human and environmental toxicity.*

*More information on pesticide regulation in the European Union and a critical review can be found the PAN Germanys'* ***Pesticide Action Handbook****, which is written for NGOs in CEEC countries.*

*Separate publications on the* ***PIC*** *and* ***POPs Convention*** *were published by PAN Germany in English, German and Russian.*

# 2 Goals

This study has got the following goals:

- to give an overview about agriculture and on pesticide use in Slovenia
- to characterise the pesticide active ingredients authorized in Slovenia by use type and chemical class;
- to reflect their regulatory status in the European Union and globally;
- to evaluate the pesticide active ingredients regarding their human and environmental toxicity, and
- to determine their potential as water and food contaminants, and
- to list national regulations addressing pesticide issues.

**Boxes in this report:**

This report can only cover up the most important aspects about pesticides. The world wide web offers a tremendous amount of information on individual pesticides, their regulation and their toxicity. In order to guide the interested reader we listed and commented particularly helpful websites. Readers, who read this text as Acrobat pdf file are able to access the cited websites via Internet Explorer or Netscape Communicator by clicking on the URL.

# 3 Slovenian Agriculture

Farming in Slovenia is characterised by its small holdings. The average farm size is about 3.5 ha and only 8% of the farms are larger than 10 ha. Over 92.000 small and mostly part-time private farms that own at least about 92% of agricultural land, produce 75% of the total agricultural output. The remaining 8% are cultivated by large agricultural companies.

The climatic conditions for agricultural production are very diverse. Four main regions can be distinguished:

The Alpine region is characterised by alpine climate with over 2.500 mm of precipitation, more than half as snow.

The central part enjoys a temperate subalpine climate with quite hot summers, well sunshine records and an average of 120 rainy days (annual precipitation 1.300-1.600 mm).

The coastal part of Slovenia has a mediterranean climate with warm to hot and dry summers, mild winters, abundant sunshine and the annual precipitation amounts to 1.100-1.300 mm.

The eastern part of Slovenia is characterised by a moderate continental climate with average air temperatures from 8-10 °C. In this part of Slovenia annual precipitation is less than 900 mm.

**General Statistics**

| | |
|---|---|
| Area: | 20.273 $km^2$ |
| Inhabitants: | 1.988.000 |
| **Agricultural Statistics** | |
| Agricultural land (ha) | 785.000[a] |
| Number of holdings | <92.000[b] |
| Employment in Agriculture | 85.000 |
| Share in employed civilian working population (%) | 9,6 |
| Share of agriculture in the gross domestic product (GDP) (%) | 4,3 |
| Share of imports from EU of food and agricultural products in imports of all products (%) | 6,7 |
| Share of exports in EU of food and agricultural products in exports of all products (%) | 4,2 |
| External trade balance in food and agricultural products (EUR) | -345.000.000 |
| Share of household consumption expenditure devoted to food, beverages and tobacco as proportion of total consumer expenditure of households (%) | 21,2 |

a. Source: Agroweb Slovenia
b. Estimated according to Agroweb Slovenia, the EU listed a number of 695.000 holdings

2000 Data, Source: EU Agricultural Statistics

Due to poor soils, hills and mountains, large parts of the country do not allow intensive agriculture.

Some 80% of the Slovenian territory belongs to the Danube catchment. Intensive agriculture we can find in the fertile valleys of the nations river.

Due to the climatic condition and the soil condition, the most important agricultural branch is animal husbandry (especially dairy), fattening cattle, pig and poultry. Sheep breeding has increased rapidly in the last few years.

Arable land and permanent crops occupy 285.000 ha, permanent pastures 502.000 ha and forests 1.1 million ha. Maize as the main crop is grown on 44.401 ha, wheat on 31.615 ha, potatoes 9.840 are grown ha, fruits on 37.514 ha, vegetables on 3941 ha and hops are grown on 1.803 ha.[1] According to the International Society for Horticultural Science, there are 5.000 ha of intensive orchards (mainly apples, pears, peaches, olives and strawberries). By cadastre there do also exist 31.000 ha of extensive old orchards. The acreage of vineyards is 25.000 ha. Annually 3.000.000 wine grafts and 700.000 maiden fruit trees are produced. Vegetables are grown on 11.500 ha of which 1.000 ha are under cover. The annual production of ornamentals is about 30.000.000 trees, bushes, and cut and pot plants.[2]

The production of corn as animal fodder occupies 40% of the arable land, which leads to a narrow crop rotation with increasing environmental and agricultural problems.[3] Excessive concentrations of the herbicide *atrazine*, its metabolites, plus a number of other herbicide, like *simazine, metolachlor* and *prometryne,* were detected in aquifers in central Slovenia. In this area, aquifers represent water sources for 45-50% of the population.[4] Extensive use of the corn herbicide *atrazine* also caused a resistance of lambsquarter (*Chenopodium album*) against this herbicide. This does probably also account for other, similar herbicides.[5] *Atrazine* was banned in Slovenia in 2002.

After severe summer droughts in 1992-1993 an irrigation programme has started in Slovenia. This programme suggested to develop an additional 10.000 ha of irrigation schemes in Slovenia in addition to the approximately 6.000 ha of already existing schemes. These irrigation schemes will mainly support the production of fruit and vegetables.

Important industrial crops for the export are sugar beets and hops. Cultivation of grapes and fruit trees ,especially apples, has got a long tradition. Slovenia is a net importer of agricultural and food products. It mostly imports cereals, sugar and pork. It exports hops, quality wine, beer, quality beef and meat products.[6] Between 1995 and 2001 overall producer prices for agricultural products decreased by 12,5% in Slovenia. Especially crop products contributed to the decline in producer prices, they fell by 26,6%, only the prices for vegetable were fairly stable. Purchase prices for animal feeding stuff, fertilisers and energy, rose by 12,6%, 13,8% and 33,36%, respectively. These trends are in contrast to the 15 EU member states, were overall producer and purchase prices fell in the same time span.[7]

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1 AgroWeb Slovenia: http://www.agroweb.bf.uni-lj.si/country.html
2 International Society for Horticultural Science website: http://www.hridir.org/countries/slovenia/
3 Annamarija Slabe, Organic Farming in Slovenia http://www.organic-europe.net/country_reports/slovenia/default.asp, FIBL (Research Institute for Organic Farming)
4 Ministry of the Environment, Spatial Planning and Energy, Republic of Slovenia (2003): Information Bulletin Environment & Planning No 90, March 2003, Lubljana
5 Website of Weed Science Society of America: http://www.weedscience.org/
6 ibid footnote 3
7 Eurostat (2002): Statistics in focus Agriculture and Fisheries theme 5 No 19/2002, Agricultural Price trends of eleven Candidate Countries as a whole keep pace with the EU Member States, Luxembourg

# 4 Agri-environmental Programme

In 1998 an agri-environmental programme (SKOP) has been initiated in Slovenia through international projects, supported by the Dutch Ministry of Agriculture. This programme has been further developed and adopted by the Slovenian government. The programme provides direct payments for a number of environmentally friendly farming practices and outlines the education- and promotion activities needed. Following agri-environmental schemes have been established:

- reduction of cattle density (220 EUR/LU),
- anti-erosion measures in orchards and vineyards (140 EUR/ha),
- widening and improvement of crop rotation (50 EUR/ha),
- introduction and maintenance of cover crops (100 EUR/ha),
- integrated management in gardening, fruit and vine growing (300 EUR/ha),
- organic agriculture (100-550 EUR/ha, depending on the crop),
- mountainous grazing (20 EUR/ha + 15 EUR/ha per shepherd),
- maintenance of high-stemmed and traditional orchards (140 EUR/ha),
- traditional (extensive) animal husbandry (45 EUR/ha),
- maintenance of extensive grasslands (25 EUR/ha),
- soil covering in water protected areas (150-300 EUR/ha, depending on the crop),
- establishment of permanent grassland (300 EUR/ha).

The agri-environmental programme has been almost entirely financed by the Slovenian government. The programme covers some 20% of the Slovenian agricultural land and involves some 10.000 farmers.[8]

# 5 Organic Argiculture

Organic agriculture in Slovenia has developed since the early 90ties. In 1997 first efforts to establish certification schemes were made. In 1998 three certification systems were in place, firstly, one established by the *Slovenian Organic Farmers' Association (S.O.F.A.)*; secondly, one by the *Association for Organic Farming in Northeast Slovenia,* whose farms were certified by the Austrian certification organisation Austria Bio Garantie. And thirdly, eighteen bio-dynamic farms were certified by German bio-dynamic inspectors. The organic standards were prepared in accordance with the IFOAM Basic Standards and are similar to the standards of Austrian and German organic farmers' associations. With Slovenias' entry in the European Union, certification schemes must comply with Council Regulation 2092/91EC.

As part of the agri-environment programme farmers whose farms were certified as organic in 1999 or in conversion in 1998, could apply for direct subsidies per hectare of agricultural land. The following subsidies were offered:

- 200 Euro for grassland

8 GFA Terra Systems/ Avalon Foundation (2002): Policies for the control of agricultural point and non-point sources of pollution and Pilot project on agricultural pollution reduction, Draft Inception Report, Hamburg, Germany

- 300 Euro for fields
- 370 Euro for intensive orchards, vegetable production and vineyards
- 450 Euro for glasshouses
- 50 Euro per farm as a subsidy for inspection and certification costs.

Farmers who applied for those payments were required to farm organically for four more years.

Table 1 shows that the number of hectares cultivated organically has risen tremendously in just 3 years. However, the percentage of organic farming in Slovenia is still below 1%.

Table 1: Number of Organic Farms in Slovenia

| Year | Total number of farms – organic and in conversion | Hectares (estimate) | % of agricultural area |
|---|---|---|---|
| 1998 | 44 (34 organic + 18 bio-dynamic*) | 400 | 0,05 % |
| 1999 | 315 (300 organic + 22 bio-dynamic*) | 3.000 | 0,38 % |
| 2000 | n.a. | 5.200 | 0,6 % |

Source: FIBL, SÖL

Organic products are marketed entirely on national markets. The most important marketing channels are:

- direct marketing;
- an organic farmers' market in Ljubljana;
- sales at conventional markets; and
- sales to health shops.

The main organic products are: fruit, vegetable, milk and simple processed products such as wine, vinegar, juice, seed oils, cheese and a few meat products.[9]

9 ibid. 3

# 6 Pesticide Use in Slovenia

Pesticide use data available for Slovenia are not up to date and rather inaccurate. Since they have been based upon sales data by formulated products, they do not present specific use data by crop or active ingredients. The FAO database provides trends of sales by chemical class only for the last two years (1997, 1998), which does not allow to evaluate a trend. The overall use, however, declined by 30% in these five years. Figure 1 shows that the use of pesticides in all categories, except fungicides, decreased. Information about the years 1999-2002 are not available. The agrochemical journal Agrow states in January 2003 that: *"In contrast to the declining western European market, there has been steady growth over the past two years in the crop protection markets of the ten EU accession countries. This is attributed to EU aid and high disease pressure in 2001."*[10] Numbers for Slovenia were, however, not published.

**European crop protection market 1999-2000 (€ million)**

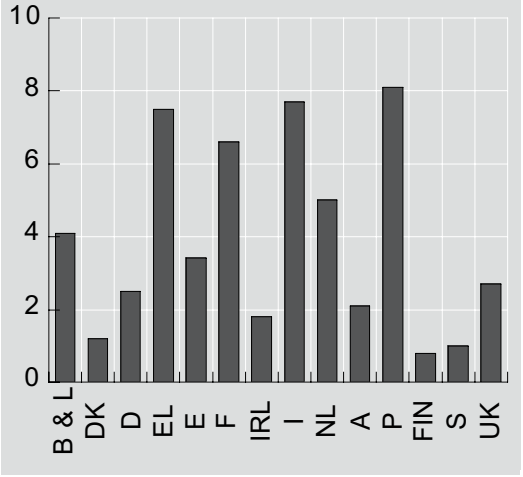
| Region | 1999[a] | % change | 2000 |
|---|---|---|---|
| EU-15 | 6.078 | -2,0 | 5.955 |
| EFTA | 98 | +4,1 | 102 |
| Five CEECs[b] | 400 | +5,0 | 420 |
| Other CEECs[c] | 265 | -1,5 | 261 |
| Russia | 153 | +18,3 | 181 |
| Total | 6.994 | -1,1 | 6.919 |

a. as reported by ECPA in 2000,
b. Czech Republic, Estonia, Hungary, Poland and Slovenia
c. rest of central and eastern Europe

Source: Agrow No 391, January 2002

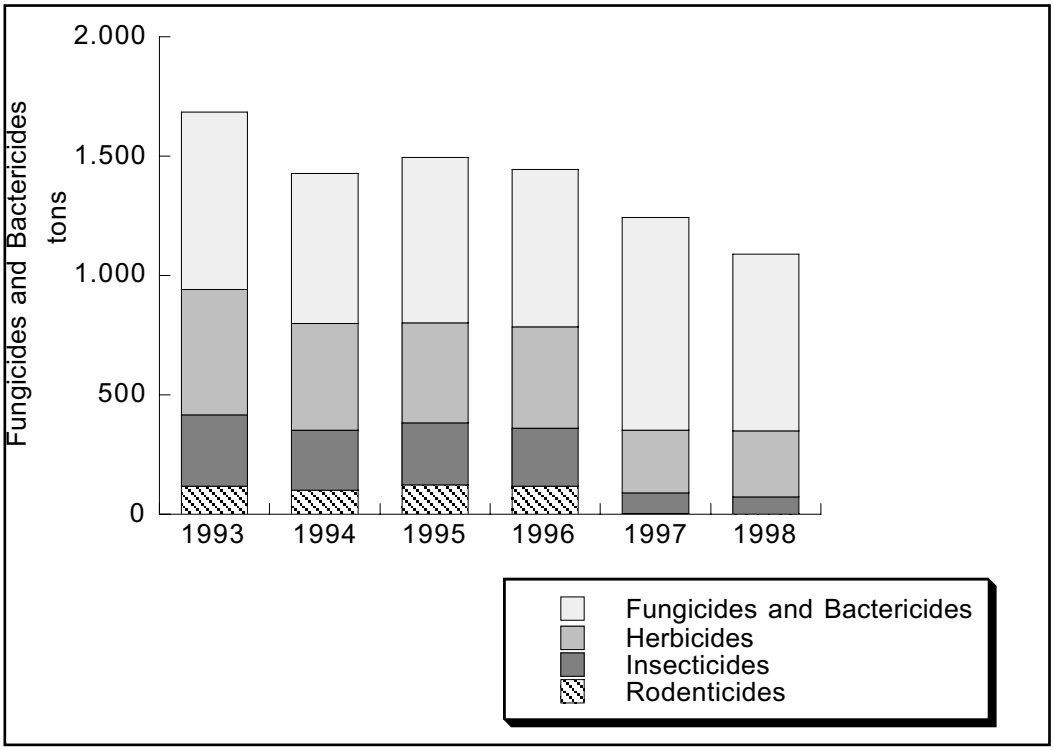
Referring to the 1998 usage data and the 285.000 hectare for arable land and permanent crop, an average use of 3,8kg/ha applies. Since this number presents the use of formulated products it cannot be compared with other countries. In addition, such numbers have to be interpreted with caution. There are approximately 92.000 small farmers in Slovenia, most of them may not use pesticides at all. In order to solve this data dilemma Slovenia could establish a pesticide use reporting system at least for the 8% of the larger farms. The Czech Republic and the Slovakian Republic maintain pesticide use reporting systems since the 1950ties and collect de tailed data from farmers with holdings larger than 10ha.

**Average Pesticide Use in the EU 1999 (kg/ha)**




10 PJB Publications Ltd (2003): Agrow No 416, January 17th 2003, page 9

Figure 1: Pesticide Use (formulated product) in Slovenia 1993 - 1998




Source: FAO

Table 2 shows the sales data by chemical class. Usage of inorganic pesticides such as *copper compounds* and *sulphur*, and dithiocarbamates (*mancozeb, maneb, thiram, propineb, ziram*) account for almost half of the total use. *Copper* compounds and *sulphur* are commonly used in vineyards and orchards, dithiocarbamates are mainly applied on potatoes, sugar beets and vegetables.

Table 2: Pesticide Use (formulated product) in Slovenia 1993 - 1998 (Mt)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| Chemclass | | | | | | |
| **Fungicides & Bactericides** | | | | | | |
| Benzimidazoles | | | | | 3 | 3 |
| Diazines, Morpholines | | | | | 6 | 6 |
| Dithiocarbamates | | | | | 201 | 240 |
| Inorganics | | | | | 565 | 377 |
| Other Fungicides | | | | | 109 | 106 |
| *Sum Fungicides & Bactericides* | 741 | 630 | 693 | 659 | 893 | 741 |
| **Herbicides** | | | | | | |
| Amides | | | | | 18 | 16 |
| Carbamates Herbicides | | | | | 3 | 3 |
| Dinitroanilines | | | | | 39 | 34 |
| Other Herbicides | | | | | 81 | 116 |
| Phenoxy Hormone Products | | | | | 48 | 41 |
| Triazine | | | | | 38 | 33 |

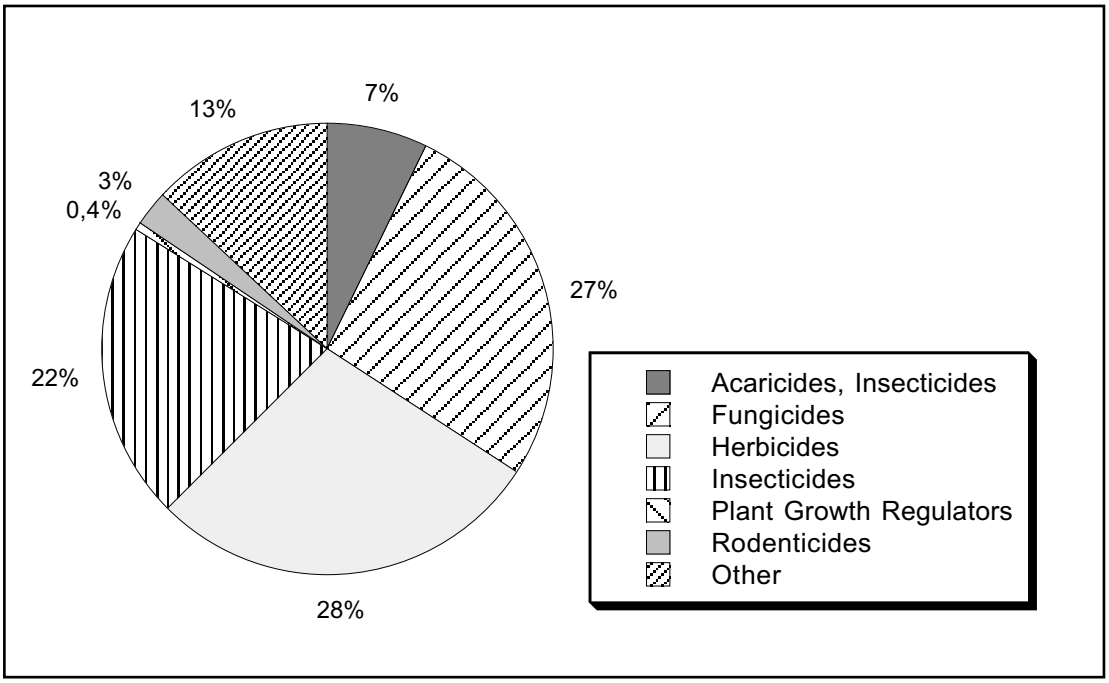
Table 2: (continued)Pesticide Use (formulated product) in Slovenia 1993 - 1998 (Mt)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| Chemclass | | | | | | |
| Triazole, Diazole | | | | | 9 | 9 |
| Urea derivates | | | | | 36 | 34 |
| *Sum Herbicides* | 526 | 446 | 418 | 425 | 263 | 277 |
| **Insecticides** | | | | | | |
| Botanic.Produc&Biologic. | | | | | | |
| Carbamates Insecticides | | | | | 2 | 1 |
| Organochlorines | | | | | 4 | 2 |
| Organo-Phosphates | | | | | 32 | 27 |
| Other Insecticides | | | | | 47 | 40 |
| Pyrethroids | | | | | 1 | 1 |
| *Sum Insecticides* | 298 | 251 | 260 | 243 | 86 | 71 |
| **Rodenticides** | | | | | | |
| Other Rodenticides | | | | | 3 | 2 |
| *Sum Rodenticides* | 119 | 102 | 124 | 117 | 3 | 2 |
| **Total** | **1.565** | **1.327** | **1.371** | **1.327** | **1.242** | **1.089** |

# 7 Characterisation of Authorized Pesticides in Slovenia

The list of the pesticide active ingredients authorized in Slovenia was obtained from the Ministry of Health/ National Chemicals Bureau. The list from 2000 includes 240 substances authorised for the use in pesticide products. Use types were assigned to the substances. Substances which are not pesticide active ingredients such as adjuvants, plant growth regulators and beneficial insects are also listed. Figure 2 shows the major use types of the 240 substances.

Figure 2: Major Use Types of Substances Authorized for Use in Pesticide Products




Source: Ministry of Health/ National Chemicals Bureau, Slovenia

Figure 2 summarises the major use types, Table 3 presents the specific type of use and the number of substances assigned.

Table 3: Authorized Substances and their Use Types

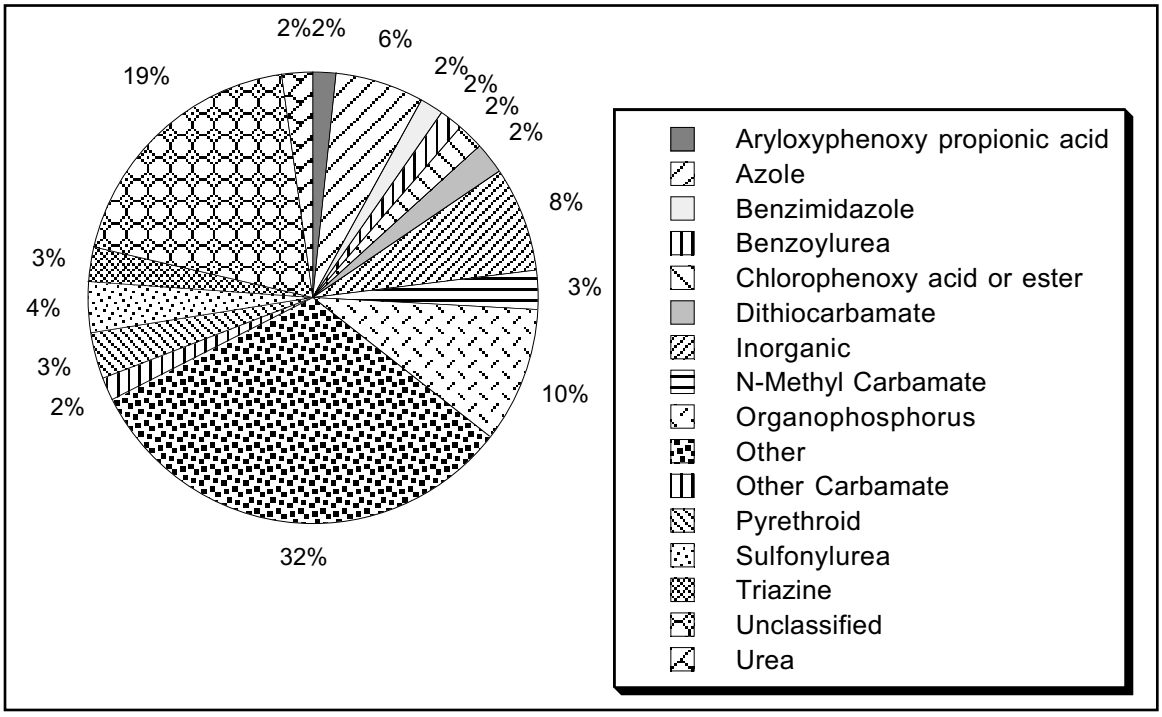
| Use Type | Abbreviation | Number of Substances |
|---|---|---|
| *Major Use Types* | | 209 |
| Acaricides, Insecticides | AC, IN | 17 |
| Fungicides | FU | 64 |
| Herbicides | HB | 67 |
| Insecticides | IN | 51 |
| Plant Growth Regulators | PG | 4 |
| Rodenticides | RO | 6 |
| *Other Use Types* | | 31 |

| Table 3: (continued) Authorized Substances and their Use Types | | |
|---|---|---|
| Use Type | Abbreviation | Number of Substances |
| Acaricides, Fungicides | AC, FU | 2 |
| Acaricides, Insecticides, Molluscicides | AC, FU, NE | 1 |
| Bacteriocides, Fungicides | BA, FU | 3 |
| Fumigants | | 2 |
| Fumigants, Fungicides, Insecticides, Nematicides, Herbicides | FU, IN, NE, HB | 1 |
| Insecticides, Nematicides | IN, NE | 2 |
| Insect Growth Regulators, Acaricides | | 1 |
| Molluscicides | MO | 2 |
| Not specified | Not spec. | 13 |
| Plant Growth Regulators, Herbicide | PG, HB | 2 |
| Soap/Surfactant | | 1 |
| Synergist | | 1 |

Source: Ministry of Health/ National Chemicals Bureau

Existing database was used to determine the chemical classes of the authorized substances. Figure 3 shows the major chemical classes of the substances. Chemical classes with 4 or less substances are summarised as *Other* in the figure.

Figure 3: Major Chemical Classes of Substances Authorized for Use in Pesticide Products



Appendix 1 lists all 240 substances with their use types and chemical classes.

**Resources to pesticides characteristics:**

Online database maintained by Pesticide Action Network North America. The most comprehensive online database on pesticides world wide is: www.pesticideinfo.org

Compendium of Pesticide Common Names, alphabetically lists some1000 pesticides, their use types and chemical classes: www.hclrss.demon.co.uk

# 8 Regulatory Status

All substances listed in Appendix 1 were registered for the use in Slovenia in the year 2000. Meanwhile a number of authorisations may be expired or new approvals were made. In 2002 for example, the use of the herbicide *atrazine* was banned in Slovenia.

In the European Union two major legal instruments regulate pesticide active ingredients.

## 8. 1 Pesticide Authorization in the European Union - Council Directive 91/414 EEC

The authorization of pesticide active ingredients is regulated through Council Directive 91/414. Major goal of the Directive is to harmonize the authorization of plant protection products, and the establishment of a positive list of active ingredients on its Annex 1. Member States can only authorize plant protection products containing active ingredients listed on Annex 1, and under consideration of its efficiency, human toxicity, environmental fate, impact of non-target organism and other aspects listed in Article 4 of Directive 91/414.[11] In accordance with Directive 91/414 pesticide active ingredients, which were authorized before 25th July 1993 must be newly reviewed regarding their toxicity and environmental fate utilising new test methods defined by other regulations. More than 800 pesticide active ingredients are undergoing this re-evaluation process. The proposed deadline for this procedure is 2008. The manufacturers of pesticide active ingredients have to finance the toxicity tests and must submit specific dossiers. For many pesticides active ingredients the expenses for the tests exceed the current or potential market volume. Therefore, for some 340 active ingredients new authorisation was not applied. After July 2003 the use of over 340 active ingredient is not allowed in the EU any more. The European Commissio assumes that further 150 active ingredients will be withdrawn by end of 2003. Altogether, some 60% of the over 800 active ingredients are then of the market.[12]

Currently, there are 54 active ingredients on Annex 1, 29 of them are so called new active ingredients (new ai), which have not been on the market in a Member State before 1993. New active ingredients can receive provisional authorization, which usually lasts 12 months.

In Slovenia 15 new active ingredients received authorization.

In Slovenia 26 of the 54 Annex 1 pesticides are authorized. For 31 pesticides, which are authorized in Slovenia, authorization will expire in 2003 in the European Union. With accession

11 European Union (1991): Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market, Official Journal 230, Brussels, Belgium

12 European Commission, Press release 4th of July 2002: 320 pesticides to be withdrawn in July 2003, http://europa.eu.int/comm/food/fs/ph_ps/pro/index_en.htm

of Slovenia in January 2004 the pesticide authorisation must comply with the European Union. This means the 31 pesticide will not be registered for use in Slovenia by 2004. Slovenia 134 of the pesticides authorized in Slovenia are still in the European re-evaluation process.

Appendix 1 lists the 240 pesticide authorized in Slovenia and their status according to Directive 91/414. All legal documents regarding the authorization of pesticides in the EU can be found under http://europa.eu.int/comm/food/fs/ph_ps/pro/index_en.htm.

**Sources:** European Commission DG Health and Consumer Protection website: http://europa.eu.int/comm/food/fs/ph_ps/pro/index_en.htm

**Critical voices**: PAN Europe (2001): Position paper on false implementation of directive 91/414 (harmonisation of pesticides), and proposals for amending the directive: www.pan-europe.net

PAN Europe report (2003): How to organise public participation in the pesticides evaluation process? www.pan-europe.net

## 8. 2 Water Framework Directive 2000/60/EEC

The Water Framework Directive 2000/60/EEC plus its related individual directives is currently the most important legal instrument concerning the pollution of the European Community's waters caused by dangerous chemicals. Directive 2000/60/EEC requires to adopt specific measurements preventing the pollution through individual contaminants and groups of contaminats, which pose a considerable risk to the aquatic environment and to sources of drinking water. Overall, the measurements of Directive 2000/60/EEC serve the internationally acknowledged goal to reduce concentrations of synthetic substances in the marine environment to sero.

Measurements regarding dangerous priority substances aim at the phase out or at the stepwise discontinuation of the pollution within 20 years after the adoption. In order to adopt specific measurement a list of priority substances including dangerous priority substances was conducted. This list can be found in Annes X of Directive 2000/60/EEC.[13] Table 4 presents substances listed in Annex X of Directive 2000/60/EEC, which are ingredients of pesticide products, and their regulatory status in Slovenia.

Table 4: Priority Substances Used as Pesticide or in Pesticide Products and their Regulatory Status in Slovenia

| Substance | Use type | Priority Substance | Priority & Dangerous Substance | Authorized in Slovenia |
|---|---|---|---|---|
| Alachlor | Herbicide | Yes | | Yes |
| Atrazine | Herbicide | Yes | Yes*** | Banned |
| Benzene | Solvent | Yes | | No |
| Chlorfenvinphos | Insecticide | Yes | | No |

13 European Community, Official Journal L331/1, Entscheidung Nr. 2455/2001/EG Des Europäischen Parlaments und des Rates vom 20. November 2001 zur Festlegung der Liste prioritärer Stoffe im Bereich der Wasserpolitik und zur Änderung der Richtlinie 2000/60/EG, Brussels

Table 4: (continued) Priority Substances Used as Pesticide or in Pesticide Products and their Regulatory Status in Slovenia

| Substance | Use type | Priority Substance | Priority & Dangerous Substance | Authorized in Slovenia |
|---|---|---|---|---|
| Chloroform | Solvent, Fumigant | Yes | | No |
| Chlorpyrifos | Insecticide | Yes | Yes*** | Yes |
| Diuron | Herbicide | Yes | Yes*** | Yes |
| Endosulfan | Insecticide | Yes | Yes*** | Yes |
| Endosulfan - alpha | Insecticide | | | No |
| Ethylene dichloride | Fumigant, Insecticide | Yes | | No |
| Hexachlorobenzene | Fungicide, Microbiocide | Yes | Yes | No |
| Hexachlorocyclohexane | Insecticide | Yes | Yes | No |
| Isoproturon | Herbicide | Yes | Yes*** | Yes |
| Lindane | Insecticide | Yes | | No |
| Methylene chloride | Solvent | Yes | | No |
| Naphthalene | Insecticide | Yes | Yes*** | No |
| Nonyl phenol | Adjuvant | | Yes | No |
| PCP | Wood Preservative, Microbiocide, Algaecide, Fungicide | | Yes*** | No |
| Pentachlorobenzene | not specified | | | No |
| Simazine | Herbicide | | Yes*** | Yes |
| Trichloromethane | Solvent | Yes | | No |
| Trifluralin | Herbicide | | Yes*** | Yes |

***Candidate; substance will be proofed as a priority dangerous substance.

Source: European Commission

**Resources to Water Directives:**

European Commission: Water Protection and Management

http://europa.eu.int/scadplus/leg/en/s15005.htm

Drinking Water Directive:

http://europa.eu.int/comm/environment/water/water-drink/index_en.html

European Environmental Bureau (EEB) a federation of non-governmental organisations (NGOs): http://www.eeb.org/activities/water/main.htm

## 8. 3 International Conventions

There are two international conventions regulating pesticides with specific properties. The Stockholm or POPs Convention and the Rotterdam or PIC Convention.

The Stockholm Convention aims at the elimination of Persistent Organic Pollutants (POPs), some of the most unwanted chemicals in the world. POPs are toxic, bioaccumulative, highly persistent and pose a global threat to all living beings. Nine of the chemicals initially targeted by the POPs convention are pesticides. All nine pesticides are not registered for use in Slovenia. The Stockholm Convention was signed in May 2001, to enter into force it now has to be ratified by at least 50 countries. Slovenia was one of the signung countries, but has not yet ratified the convention.[14]

The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in Rotterdam on 10 September 1998. The Prior Informed Consent (PIC) Procedure is voluntary, but it has been unanimously accepted by member countries of the Foos and Agricultual Organisation (FAO) and the United Nations Environmental Programme (UNEP) and is supported by the leading chemical industry associations. Slovenia signed and but did not ratify the convention so far.[15] The PIC Procedure disseminates information about the characteristics of potentially hazardous chemicals to the participating countries. It initiates a decision making process on the future import of these chemicals by the countries, and makes it possible to circulate this decision other countries.

Pesticides, industrial and consumer chemicals that have been banned or severely restricted for health or environmental reasons by the participating governments can be included in the procedure. In addition acutely toxic pesticide formulations which present a hazard under the conditions of use in developing countries may also be included.

The PIC procedure is an instrument, which formalises the decisions of importing countries concerning the import of such chemicals. The aim is to promote a shared responsibility between exporting and importing countries in protecting human health and the environment from the harmful effects of certain hazardous chemicals being traded internationally.[16] Table 5 list all PIC pesticide, their type of use, and their regulatory status in Slovenia.

Table 5: PIC Pesticides and their Status of Authorization in Slovenia

| Pesticide | Use Type | PIC Pesticide | Authorized in Slovenia |
|---|---|---|---|
| 2,4,5-T | Herbicide | Yes | No |
| 2-Fluoroacetamide | Rodenticide, Insecticide | Yes | No |
| Aldrin | Insecticide | Yes | No |
| Binapacryl | Herbicide | Yes | No |
| Captafol (isomer unspec.) | Fungicide | Yes | No |
| Carbofuran | Insecticide | Candidate | Yes |
| Chlordane | Insecticide | Yes | No |

14 UNO website: http://www.unece.org/env/lrtap/status/98pop_st.htm
15 FAO website: http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/Pesticid/PIC/convlist.htm
16 Website of the international PIC office: www.pic.int

| Table 5: (continued) PIC Pesticides and their Status of Authorization in Slovenia | | | |
|---|---|---|---|
| Pesticide | Use Type | PIC Pesticide | Authorized in Slovenia |
| Chlordimeform | Insecticide | Yes | No |
| Benomyl | Fungicide | Candidate | Yes |
| DDT | Insecticide | Yes | No |
| Dieldrin | Insecticide | Yes | No |
| Dinoseb | Herbicide, Defoliant | Yes | No |
| Ethylene dibromide | Fumigant | Yes | No |
| Ethylene dichloride | Fumigant, Insecticide | Yes | No |
| Ethylene oxide | Fumigant | Yes | No |
| Heptachlor | Insecticide | Yes | No |
| Hexachlorobenzene | Fungicide, Microbiocide | Yes | No |
| Hexachlorocyclohexane (HCH) | Insecticide | Yes | No |
| Lindane | Insecticide | Yes | No |
| Merpafol cis isomer | Fungicide | Yes | No |
| Methamidophos | Insecticide, Breakdown product | Yes | No |
| Methyl parathion | Insecticide | Yes | No |
| Monocrotophos | Insecticide | Yes | No |
| Parathion | Insecticide | Yes | Yes |
| PCP | Wood Preservative, Microbiocide, Algaecide, Fungicide | Yes | No |
| Phosphamidon | Insecticide | Yes | No |
| Thiram | Fungicide | Candidate | Yes |
| Toxaphene | Insecticide | Yes | No |

**Recources to POPs and PIC Convention:**

United Nations Environmental Programme (UNEP) POPs website: www.chem.unep.ch/pops or Stockholm Convention (POPs Convention) website: www.pops.int/

United Nations Environmental Programme (UNEP), website of Interim Secretariat for the Rotterdam Convention (PIC convention): www.pic.int

# 9 Human Toxicity Classification and Health Effects of Pesticides Authorized in Slovenia

The human toxicity defines the different types of chronic and acute toxicity pesticides cause in humans, including cancer, reproductive and developmental toxicity, endocrine disruption and cholinesterase inhibition.

Various international established criteria for the evaluation of the human toxicity do exist. The generally accepted “Recommended Classification of Pesticides by Hazard And Guidelines to Classification” published by the World Health Organisation (WHO)[17] will be used to evaluate

the acute toxicity of the pesticide authorized in Slovenia. Irreversible effects will be evaluated using classifications of the International Agency of Research on Cancer (IARC), the European Union, the U.S. Environmental Protection Agency (U.S. EPA) and the *acceptable daily intake* (ADI) of the WHO. Additional information about adverse effects, such as endocrine disrupting effects and cholinesterase inhibition will be provided as well.

The summarised listings and categories of pesticide authorized in Slovenia can be found in Appendix 2. A number of pesticide ingredients were excluded from the evaluation list, these are beneficial organism, inorganic compounds and unclassified substances. Altogether 22 substances were excluded. The exclusion was done because toxicity information for most of these compound is not available.

The following Chapter have largely been taken from two studies: *Beyond POPs - Evaluation of Evaluation of the UNEP Chemical Substitutes of the POPs Pesticides Regarding their Human and Environmental Toxicity*[18] and from the Risk Study in *From Law to Field - Pesticide Use Reduction in Agriculture - From Pesticide Residue Analyses to Action.*[19]

## 9. 1 Acute Toxicity - World Health Organisation (WHO)

*166 of the ingredients authorized in Slovenia are classified by the WHO: 8 as Extremely Hazardous, 11 as Highly Hazardous, 30 as Moderately Hazardous, 41 as Slightly Hazardous and 76 as Unlikely to present hazard in normal use.*

The acute toxicity of a substance is widely used and accepted as criteria for risk assessment. Standardised animal tests, primarily with rats, are employed to determine the $LD_{50}$, the estimated dose which is lethal to 50 percent of the tested population.

In 1975 the WHO published, with approval from the 28th World Health Assembly, their first classification of pesticides by hazard. The guidelines on the classification of individual pesticides, the actual tables, were established in 1978 and have since been revised at two-year intervals.[20] The WHO classification is based on the physical state of an active ingredient (“solid” or “liquid”) and on $LD_{50}$ values for rats via dermal and oral routes. The recommended classification of pesticides are presented in Table 6. $LD_{50}$ values via inhalation are not included in the classification. This is a major deficiency because users of pesticides are often exposed by air. Formulations and mixtures are also not included in the classification. The acute toxicity of formulations and mixtures can be calculated with a given calculation which is derived from the percentage and the $LD_{50}$ values of active ingredients in the formulation or mixture. The potential increase in acute toxicity due to so-called ‘inert’ ingredients[21] [22] is neglected in this calcu-

17 World Health Organisation (2000-02): The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2000-02 (WHO/PCS/01.5), WHO, Vienne, Switzerland

18 Neumeister, L. (2001): Beyond POPs - Evaluation of Evaluation of the UNEP Chemical Substitutes of the POPs Pesticides Regarding their Human and Environmental Toxicity, Pestizid Aktions-Netzwerk Germany, Hamburg, Germany

19 Neumeister, L., Mücke, M., Ruhnau, M. Weber C., (2002): From Law to Field - Pesticide Use Reduction in Agriculture - From Pesticide Residue Analyses to Action, Pestizid Aktions-Netzwerk Germany, Hamburg, Germany

20 World Health Organisation (2000-02): The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2000-02 (WHO/PCS/01.5), WHO, Vienne, Switzerland

21 “inert” ingredient: 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 labelled on the product and therefore not included in the calculation. (More information see footnote 22.)

lation. Health effects other than acute toxicity, such as carcinogenicity, have been taken into account for many compounds; the classification has been accordingly adjusted.

Table 6: WHO Recommended Classification of Pesticides by Hazard

| Classification | | $LD_{50}$ in rat (mg/kg body weight) | | | |
|---|---|---|---|---|---|
| | | Oral | | Dermal | |
| | | Solids | Liquids | Solids | Liquids |
| Ia | Extremely hazardous | 5 or less | 20 or less | 10 or less | 40 or less |
| Ib | Highly hazardous | 5 - 50 | 20 - 200 | 10-100 | 40 - 400 |
| II | Moderately hazardous | 50 - 500 | 200 - 2000 | 100-1000 | 400 - 4000 |
| III | Slightly hazardous | Over 500 | Over 2000 | Over 1000 | Over 4000 |

Source: World Health Organisation (2000-02): The WHO Recommended Classification of Pesticides by Hazard And Guidelines to Classification 2000-02

The WHO classification guidelines are a collection of proposed data reviewed by the International Programme on Chemical Safety (IPCS). Any interested party can propose new entries or comment on entries, provided tests and data are representative.

When several $LD_{50}$ values have been reported, the WHO/IPCS uses the lowest reliable value. Usually the oral route values are used, except when the dermal route value places the substance in a more hazardous class.

219 ingredients authorized in Slovenia are listed in the WHO classifications. The acute toxicity classification of them can be found in Appendix 2.

## 9. 2 Acute Toxicity - European Union

*128 of the ingredients authorized in Slovenia are classified by the European Union: 18 as Very Toxic, 22 as Toxic, 63 as Harmful and 11 as Irritant.*

The major legislative framework in force dealing with dangerous substances in the European Union is the Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.[23] There have been 28 amendments, adoptions and/ or modifications since establishing this framework. Most of them can be found on the website of the European Union.[24] The list of chemicals, their risk classification, information on labelling, packaging and safe use can be found as Annex I of this directive. This Annex I was completely and updated obtained from the responsible European Chemicals Bureau.[25] The classification system of the EU goes further than the WHO acute toxicity classification. The combination of danger symbols

22 Marquardt, S., Cox, C., Knight, H. (1998): Toxic Secrets, “Inert” Ingredients in Pesticides 1987-1997, Northwest Coalition for Alternatives on Pesticides, Californians for Pesticide Reform

23 European Union (1967): Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal 196, Brussels, Belgium

24 European Union (2000): Legislation in Force, http://www.europa.eu.int/eur-lex/en/lif/dat/1994/en_294A0103_51.html, Brussels, Belgium

25 personel communication with Dr. Elisabet Berggren (Classification/Labelling and Export/Import), European Chemicals Bureau, Italy, April 2001

for acute hazards with descriptive risk phrases for acute as well as subchronic and chronic toxicity, plus the categories for mutagenic, carcinogenic and reproductive effects, presents a fairly comprehensive instrument for the evaluation of chemicals.

The symbols and risk phrases describe following effects:

- acute toxicity (lethal and irreversible effects after a single exposure)
- subacute, subchronic or chronic toxicity
- corrosive and irritant effects
- sensitising effects
- specific effects on health (carcinogenicity, mutagenicity and reproductive toxicity)

The description of the criteria can be found in the amendment paper 393L0021 (Commission Directive 93/21/EEC of 27 April 1993), a modification to the directive 67/548/ EEC.

There are three acute toxicity classifications (see following table) and, in contrast to the WHO classification, the exposure routes via air are included in the classification system. The specific effects on health such as carcinogenicity, mutagenicity and reproductive toxicity will be addressed in Chapter 9. 4. 3.

The toxicity of the ingredients authorized in Slovenia, according to the classification of the European Union, can be found in Appendix 2 as well as the risk phrases and the descriptions of the symbols.

Table 7: Acute Toxicity Classification - Danger Symbols and Risk Phrases in the European Union

| Classification | | LD50 in rat mg/kg body weight | | | Risk Phrases |
|---|---|---|---|---|---|
| | | Oral | Dermal[a] | Inhalation[b] | |
| T+ | Very toxic | 25 | 50 | 0,25 | 28, 27, 26, 39[c] |
| T | Toxic | 25 -200 | 50 - 400 | 0,25 to 1 | 23, 24, 25, 39, 48[d] |
| Xn | Harmful | 200 - 2000 | 400 - 2000 | 1 to 5 | (22)[e], 65, 40[f], 48 |

a. test species rat or rabbit for “Dermal”
b. Lethal Concentration = LC50 in rat mg/litre par 4 hours
c. Danger of very serious irreversible effects - Strong evidence that irreversible damage is likely to be caused by a single exposure
d. Danger of serious damage to health by prolonged exposure
e. replaced by R65
f. Possible risk of irreversible effects - strong evidence that irreversible damage is likely to be caused by a single exposure

The partly remarkable differences between the acute toxicity classification of the WHO and the EC are due to the fact that the WHO incorporates other health effects in addition to the acute toxicity for some substances. Several entries into the toxicity category define different toxicities for different exposure routes. The risk phrases 24-26/28, for instance, mean R24: Toxic in contact with skin and R26/28: Very toxic by inhalation and if swallowed.

## 9. 3 Cholinesterase Inhibition

*26 of the ingredients authorized in Slovenia are cholinesterase inhibitors (ChE).*

Pesticides undergo different modes of action: organophosphorus (OP) and N-methyl carbamate (CB) pesticides inhibit primarily the acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) enzymes by phosphorylation and carbamation, respectively. This simply means that these pesticides change the enzyme structure, and therefore the enzyme becomes inactivated. Acetylcholinesterase is responsible for turning off the signal flow ensured by the neurotransmitter acetylcholine between a nerve cell and a target cell; for instance, a muscle fiber, gland or another nerve cell. Since the neurotransmitters are in charge of passing on a signal which leads to a stimulation, the inhibition of the signal-stopping enzyme leads to an overstimulation. This overstimulation is the reason, usually due to pulmonary secretion and respiratory failure, for the death of the poisoned person.[26]

As in all poisoning, the grade of poisoning is dependant upon several parameters: exposure time, exposure dose, age, gender and constitution of the affected person.

There is very little knowledge regarding the function of butyrylcholinesterase (BuChE) in the nervous system. Several uncertainties have been defined. For example, it is not known if BuChE plays a role in the development and/or functioning of the nervous system, nor is it known if BuChE and/or AChE and other esterases play a more general role in cell growth and cell death, including in carcinogenesis. Over cholinergic pathways, the neurotransmitter acetylcholine acts in the entire human body: in the central nervous system (brain and spinal cord), as well as the peripheral nervous system. Little is known about the distribution of cholinergic pathways in the brain and their functions. Behavioural, cognitive, and psychological changes can only be observed on humans; animal testing fails here in most cases. There is also little knowledge about the effects of longer term/ low dose exposures. The complexity of cholinesterase inhibition caused by pesticides can therefore hardly be assessed.

The approach of the U.S. EPA Office of Pesticide Programmes (OPP) is to measure cholinesterase inhibition in blood cells, but they also admit that more research needs to be done to appropriately address the complex effects. The Science Advisory Panel of OPP notes that *"...under SOME circumstances, measurement of SOME blood-borne cholinesterases would be appropriate to consider in establishing RfDs*[27] *for anticholinesterases...."*,and *"Measured inhibition of cholinesterase activities in any of the blood fractions is best regarded as an imperfect mirror of enzyme inhibition in the true target tissues...."*[28]

At least two organisations use the measurement of cholinesterase inhibition in the blood: the California Department of Health Services (CDHS) removes agricultural workers who have been in contact with highly toxic organophosphorous or carbamate compounds and whose blood plasma or red blood cell levels show a certain percentage of cholinesterase inhibition from the workplace. The World Health Organisation (WHO) has similar guidelines as the CDHS and considers plasma inhibition of 50% a 'toxic' decrease.[29]

26 Reigart, J. R., Roberts, J. R. (1999): Recognition and Management of Pesticide Poisonings, Office of Prevention, Pesticides, and Toxic Substances, US Environmental Protection Agency, Washington, USA

27 Reference Dose, (note of the author)

28 U.S. EPA, Office of Pesticide Programmes (2000): Science Policy on The Use of Data on Cholinesterase Inhibition for Risk Assessments of Organophosphorous and Carbamate Pesticides, p. 16. Office of Pesticide Programme, US Environmental Protection Agency, Washington, USA

## 9. 4 Chronic Toxicity and Irreversible Damages

Chronic toxicity and irreversible damages caused by pesticides include: cancer; mutagenic, developmental, and reproductive toxicity; endocrine disrupting; and potential after-effects of cholinesterase inhibition. The latter has been discussed in Chapter 9. 3.

The procedures by which most organisations classify chemicals as carcinogenic, mutagenic or developmental and reproductive toxicants are often very similar. They mostly involve first the selection of chemicals to evaluate, then bringing together a board of scientists who evaluate the available data and make a decision about a ranking, based upon the weight of the evidence. The data evaluated include in most cases epidemiological studies on humans exposed to the chemical, as well as studies on laboratory animals. Some organisations also use the evaluation results of other authorities and apply a new classification to it. Pesticides which have been on the market for a longer time have been studied often more extensively than 'newer' chemicals. The more available data base results in a presumably more accurate rating.

### 9. 4. 1 Carcinogenicity Classification - International Agency for Research on Cancer (IARC)

*23 of the ingredients authorized in Slovenia are evaluated by the IARC: 7 as possibly carcinogenic to humans. 16 are considered as not classifiable as carcinogenic to humans*.

The International Agency for Research on Cancer (IARC) is part of the World Health Organisation (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, some 860 agents have been reviewed. Participants in the working groups are individual scientists who do not represent organisations, industry or governments.Their task is:

- to ensure that all appropriate data have been collected;
- to select the relevant data;
- to prepare summaries of the data to enable the reader to follow the reasoning of the working group;
- to evaluate the results of epidemiological and experimental studies on cancer;
- to evaluate data relevant to the understanding of mechanism of action; and
- to make an overall evaluation of the carcinogenicity of the exposure to humans.[30]

29 U.S. EPA, Office of Pesticide Programmes (2000): Science Policy on The Use of Data on Cholinesterase Inhibition for Risk Assessments of Organophosphorous and Carbamate Pesticides, Office of Pesticide Programme, US Environmental Protection Agency, Washington, USA

30 International Agency for Research on Cancer (1999): Preamble to the IARC Monographs, IARS Monographs, accessible through: http://www.iarc.fr/, Lyon, France

The evaluation leads to a classification which is divided into five groups as displayed in the Table 8.

| Table 8: IARC Classification on Carcinogenicity | |
|---|---|
| Category | Description |
| Group 1 | The agent (mixture) is carcinogenic to humans. |
| Group 2A | The agent (mixture) is probably carcinogenic to humans. |
| Group 2B | The agent (mixture) is possibly carcinogenic to humans. |
| Group 3 | The agent (mixture) is not classifiable as to its carcinogenicity to humans. |
| Group 4 | The agent (mixture) is probably not carcinogenic to humans. |

None of the ingredients registered in Slovenia, is classified as probably carcinogenic to humans (Group 2A) by the IARC. This category is used when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. Seven of the ingredients authorized in Slovenia are classified as possibly carcinogenic to humans (Group 2B). This classification is applied when limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals exist. It also may be used when adequate evidence of carcinogenicity in humans does not exist but there is sufficient evidence of carcinogenicity in experimental animals. In some cases, a substance for which adequate evidence of carcinogenicity in humans does not exist *but* for which limited evidence of carcinogenicity in experimental animals together with supporting evidence from other relevant data is present, may be placed in this group. Sixteen are not classifiable as carcinogenic to humans (Group 3). This group is applied mostly for substances for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals.

### 9. 4. 2 Carcinogenicity Classification - U.S. Environmental Protection Agency (U.S. EPA)

The U.S. EPA Office of Pesticide Programmes maintains a List of Chemicals Evaluated for Carcinogenic Potential.[31]This list is a product of the general risk assessment included in the process of the pesticide registration. This classification can be seen as a development of the IARC classification system, but also includes the potential exposure of humans.[32] 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 three times over the last 15 years. The categories used by U.S. EPA between 1986 to the present are presented in the following tables:

| Table 9: U.S. EPA Classification of Carcinogenic Substances (1986 - 1996) | |
|---|---|
| Category | Description |
| Category A | Known to cause cancer in humans. Generally based on epidemiological data showing sufficient evidence to support a causal association between exposure to the substance and cancer. |

31 US Environmental Protection Agency Office of Pesticide Programmes (2000): List of Chemicals Evaluated for Carcinogenic Potential, U.S. EPA Office of Pesticide Programmes, Washington, DC, USA

32 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

| Table 9: (continued) U.S. EPA Classification of Carcinogenic Substances (1986 - 1996) | |
|---|---|
| Category | Description |
| Category B | Known to cause cancer in animals but not yet definitively shown to cause cancer in humans. These chemicals are designated “probable human carcinogens.” Category B is further split into pesticides for which some evidence exists that it causes cancer in humans (B1) and those for which evidence exists only in animals (B2). |
| Category C | Possible human carcinogens, where the data show limited evidence of carcinogenicity in the absence of human data. |
| Category D | This category is for chemicals for which the data are either incomplete or ambiguous and is labelled “cannot be determined.” This category is appropriate when tumour effects or other key data are suggestive or conflicting or limited in quantity and are thus not adequate to convincingly demonstrate carcinogenic potential for humans. In general, further chemical-specific and generic research and testing are needed to be able to describe human carcinogenic potential. |
| Category E | Probably not carcinogenic, with no evidence of carcinogenicity in at least two adequate animal tests in different species in adequate epidemiological and animal studies. This classification is based on available evidence and does not mean that the agent will not be a carcinogen under any circumstances. |

| Table 10: U.S. EPA Classification of Carcinogenic Substances (1996 - 1999) | |
|---|---|
| Category | Description |
| Known/Likely | This category of descriptors is appropriate when the available tumor effects and other key data are adequate to convincingly demonstrate carcinogenic potential for humans; it includes:<br>Agents known to be carcinogenic in humans based on either epidemiologic evidence of a combination of epidemiologic and experimental evidence, demonstrating causality between human exposure and cancer. Agents that should be treated as if they were known human carcinogens, based on a combination of epidemiologic data showing a plausible causal association (not demonstrating it definitively) and strong experimental evidence. Agents that are likely to produce cancer in humans due to the production or anticipated production of tumors by modes of action that are relevant or assumed to be relevant to human carcinogenicity. |

| Table 10: (continued) U.S. EPA Classification of Carcinogenic Substances (1996 - 1999) | |
|---|---|
| Category | Description |
| Cannot be determined | This category of descriptors is appropriate when available tumor effects or other key data are suggestive or conflicting or limited in quantity and thus, are not adequate to convincingly demonstrate carcinogenic potential for humans. In general, further agent-specific and generic research and testing are needed to be able to describe human carcinogenic potential. The descriptor 'cannot be determined' is used with a subdescriptor that further specifies the rationale:<br>Agents whose carcinogenic potential cannot be determined, but for which there is suggestive evidence that raises concern for carcinogenic effects. Agents whose carcinogenic potential cannot be determined because the existing evidence is composed of conflicting data (e.g., some evidence is suggestive of carcinogenic effects, but other equally pertinent evidence does not confirm any concern), agents whose carcinogenic potential cannot be determined because there are inadequate data to perform an assessment. Agents whose carcinogenic potential cannot be determined because no data arr available to perform an assessment. |
| Not likely | This is the appropriate descriptor when experimental evidence is satisfactory for deciding that there is no basis for human hazard concern, as follows (in the absence of human data suggesting a potential for cancer effects): Agents not likely to be carcinogenic to humans because they have been evaluated in at least two well conducted studies in two appropriate animal species without demonstrating carcinogenic effects. Agents not likely to be carcinogenic to humans because they have been appropriately evaluated in animals and show only carcinogenic effects that have been shown not to be relevant to humans (e.g., showing only effects in the male rat kidney due to accumulation of alpha(2u)-globulin). Agents not likely to be carcinogenic to humans when carcinogenicity is dose or route dependent. For instance, not likely below a certain dose range (categorized as likely by another route of exposure). To qualify, agents will have been appropriately evaluated in animal studies and the only effects show a dose range or route limitation, or a route limitation is otherwise shown by empirical data. Agents not likely to be carcinogenic to humans based on extensive human experience that demonstrates lack of effect (e.g., phenobarbital). |

| Table 11: U.S. EPA Classification of Carcinogenic Substances (1999 to present) | |
|---|---|
| Category | Description |
| Carcinogenic to humans | This descriptor is appropriate when there is convincing epidemiologic evidence demonstrating causality between human exposure and cancer. This descriptor is also appropriate when there is an absence of conclusive epidemiologic evidence to clearly establish a cause and effect relationship between human exposure and cancer, but there is compelling evidence of carcinogenicity in animals and mechanistic information in animals and humans demonstrating similar mode(s) of carcinogenic action. It is used when all of the following conditions are met:<br>There is evidence in a human population(s) of association of exposure to the agent with cancer, but not enough to show a causal association, and There is extensive evidence of carcinogenicity, and<br>The mode(s) of carcinogenic action and associated key events have been identified in animals, and<br>The key events that precede the cancer response in animals have been observed in the human population(s) that also shows evidence of an association of exposure to the agent with cancer. |
| Likely to be carcinogenic to humans | This descriptor is appropriate when the available tumor effects and other key data are adequate to demonstrate carcinogenic potential to humans. Adequate data are within a spectrum. At one end is evidence for an association between human exposure to the agent and cancer and strong experimental evidence of carcinogenicity in animals; at the other, with no human data, the weight of experimental evidence shows animal carcinogenicity by a mode or modes of action that are relevant or assumed to be relevant to humans. |
| Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential | This descriptor is appropriate when the evidence from human or animal data is suggestive of carcinogenicity, which raises a concern for carcinogenic effects, but is judged not sufficient for a conclusion as to human carcinogenic potential. Examples of such evidence may include; a marginal increase in tumors that may be exposure-related, or evidence is observed only in a single study, or the only evidence is limited to certain high background tumors in one sex of one species. Dose-response assessment is not indicated for these agents. Further studies would be needed to determine human carcinogenic potential. |
| Data are inadequate for an assessment of human carcinogenic potential | This descriptor is used when available data are judged inadequate to perform an assessment. This includes a case when there is a lack of pertinent or useful data or when existing evidence is conflicting, e.g., some evidence is suggestive of carcinogenic effects, but other equally pertinent evidence does not confirm a concern. |

| Table 11: (continued) U.S. EPA Classification of Carcinogenic Substances (1999 to present) | |
|---|---|
| Category | Description |
| Not likely to be carcinogenic to humans | This descriptor is used when the available data are considered robust for deciding that there is no basis for human hazard concern. The judgement may be based on: Extensive human experience that demonstrates lack of carcinogenic effect (e.g., phenobarbital). Animal evidence that demonstrates lack of carcinogenic effect in at least two well designed and well conducted studies in two appropriate animal species (in the absence of human data suggesting a potential for cancer effects). Extensive experimental evidence showing that the only carcinogenic effects observed in animals are not considered relevant to humans (e.g., showing only effects in the male rat kidney due to accumulation of alpha-2u-globulin).Evidence that carcinogenic effects are not likely by a particular route of exposure. Evidence that carcinogenic effects are not anticipated below a defined dose range. |

Source: EPA (2000): List of Chemicals Evaluated for Carcinogenic Potential

Appendix 2 lists pesticides authorized in Slovenia and their cancer category assigned by U.S. EPA. Reflecting the classification date, all three types of categories can be found in Appendix 2.

### 9. 4. 3 Classifications of Carcinogenic, Mutagenic and Reproductive Toxicants - European Union

*17 of the ingredients authorized in Slovenia cause concern for humans due to possible carcinogenic effects and have been placed into the carcinogenicity category 3 by the EU.* 6 *cause concern for humans owing to possible mutagenic effects and have been placed into the mutagenicity category 3. 3 may cause harm to the unborn child, 7 present possible risks of harm to the unborn child, 2 may impair fertility, 2 present possible risk s of impaired fertility and 1 may cause harm to breast-fed babies.*

The classification of carcinogenic, mutagenic and reproductive toxicants is part of the Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.[33] In the 18th amendment[34] of this directive the procedure of labelling and classification is described. The process of classification differs considerably from other organisations.

The manufacturer of a substance is required to implement the testing according to Annex V of the Directive 67/548/EEC, which describes the methods to determine the physical-chemical properties, the human and the environmental toxicity.[35] They have to submit all available relevant data to the Member State in which the substance is planned to be sold. In addition the manufacturer has to label its substance provisionally according to the EU criteria. If the manu-

33 European Union (1967): Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal 196, Brussels, Belgium

34 European Union (1993): Council Directive 93/21/EEC of 27 April 1993 adapting to technical progress for the 18th time Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

35 This Annex has been updated regularly in light of the technical progress. Test methods of the OECD are mostly being used.

facturer gains new relevant data, these are also required to be presented as soon as possible to the Member State. The preliminary classification applied by the manufacturer is valid as long as no other conclusions about the substance can be reached or as long as no Member State has relevant information justifying (or not) the categories. Member States which have relevant data on this substance are obligated to forward this information to the Commission. The Commission forwards the information about classification and labelling of the substance to all Member States, who may notify the Commission in case their own data prove the classification inappropriate. If no objections or newer relevant data arise, the preliminary classification is valid until the substance is officially classified and registered by the EC. The following chapter describes the EC classification of carcinogenic, mutagenic substances, and substances toxic to reproduction.

### Carcinogenicity

The European Union defines three categories for carcinogenicity, which are presented in Table 12. There are inherent difficulties in assigning substances into Category 1 due to the fact that this is done on the basis of epidemiological data.[36] Therefore it seems to be impossible to classify products which have been on the market for a short time or for products with a low volume of production i.e. low exposure potential. The exact processes and the principles of assessment to place a substance in Category 1 have not been documented.

Placing a substance into Categories 2 and 3 is based primarily on animal experiments. To assign a substance to Category 2, two animal species should show positive results, or one species should show clear evidence of carcinogenicity. In addition, other supporting evidence must exist.

Category 3 places substances which are well investigated but for which the evidence of carcinogenic effects are insufficient for classification in Category 2. Category 3 also places substances which are insufficiently investigated. The available data are inadequate, but they raise concern for humans. This classification is temporary; further investigations are necessary before a final classification can be made. For a distinction between Category 3 and a classification as non-carcinogenic, the following criteria are valid:

- the substance should not be classified in any of the categories if the mechanism of experimental tumour formation is clearly identified, with good evidence that this process cannot be extrapolated to humans,
- the substance may not be classified in any of the categories if the only available tumour data are liver tumours in certain sensitive strains of mice, without any other additional evidence,
- particular attention should be paid to cases where the only available tumour data are the occurrence of neoplasms at sites and in strains where they are well known to occur spontaneously with a high incidence.

36 European Union (1993): Council Directive 93/21/EEC of 27 April 1993 adapting to technical progress for the 18th time Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

The EU description of the criteria fails to mention whether or not 'newer' substances due to insufficient investigation are automatically placed into Category 3.

Table 12:EU Classification of Carcinogenic Substances

| Category | Description | Symbol & Risk Phrases |
|---|---|---|
| Category 1 | Substances known to be carcinogenic to humans. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer. | T; R45 May cause cancer;<br>T; R49 May cause cancer by inhalation |
| Category 2 | Substances which should be regarded as if they are carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer, generally on the basis of appropriate long-term animal studies or other relevant information. | T; R45 May cause cancer<br>T; R49 May cause cancer by inhalation |
| Category 3 | Substances which cause concern for humans owing to possible carcinogenic effects but in respect of which the available information is not adequate for making a satisfactory assessment. There is some evidence from appropriate animal studies, but this is insufficient to place the substance in Category 2. | Xn; R40 Limited evidence of a carcinogenic effect.[a] |

a. Risk phrase R40 changed. (Commission Directive 2001/59/ECof 6 August 2001adapting to technical progress for the 28th time Council Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances)

## Mutagenicity

The European Union defines three categories for mutagenicity, which are presented in Table 13. With Directive 2000/32/EEC of 19th May 2000 the European Union modified the Directive 67/548EEC for the 26th time.[37] This modification deals almost solely with testing methods for mutagenic substances and has to be enforced by the Member States by the 1st June of 2001. It is to expect that the application of newer test methods will change the assessment and classification of substances in the EU.

To place a substance in Category 1, positive evidence from human mutation epidemiology studies is needed. According to the EU, examples of such substances are not known to date. For Category 1 mutagenicity the same objections as for Category 1 in the Chapter on Carcinogenicity (page 30) may arise. To place a substance in Category 2, positive results are needed from experiments showing mutagenic effects or other cellular interactions relevant to mutagenicity in germ cells of mammals in vivo, or mutagenic effects in somatic cells of mammals in vivo in combination with clear evidence that the substance or a relevant metabolite reaches the germ cells.

Six of the Pesticides Authorized in Slovenia have been placed into Category 3. To place a substance in Category 3, positive results are needed in experiments showing mutagenic effects or

37 European Union (2000): Council Directive 2000/32/EEC of 19 May 2000 adapting to technical progress for the 26th time Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 136, Brussels, Belgium

other cellular interaction relevant to mutagenicity, in somatic cells in mammals in vivo. The latter especially would usually be supported by positive results from in vitro mutagenicity experiments.

Additionally, a distinction between Category 3 and no classification is not described.

Table 13:EU Classification of Mutagenic Substances

| Category | Description | Symbol & Risk Phrases |
|---|---|---|
| Category 1 | Substances known to be mutagenic to humans.<br>There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage. | T; R46 May cause heritable genetic damage. |
| Category 2 | Substances which should be regarded as if they are mutagenic to humans.<br>There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of appropriate animal studies, or other relevant information. | T; R46 May cause heritable genetic damage. |
| Category 3 | Substances which cause concern for humans owing to possible mutagenic effects. There is evidence from appropriate mutagenicity studies, but this is insufficient to place the substance in Category 2. | Xn; R68[a] Possible risk of irreversible effects. |

a. New risk phrase R68. (Commission Directive 2001/59/ECof 6 August 2001adapting to technical progress for the 28th time Council Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances)

## Reproductive Toxicity

There are three categories for the classification of substances toxic to the reproduction. To place a substance into Category 1 sufficient evidence must exist that there is a causal relationship between impaired fertility and/ or developmental toxic effects and human exposure. This actually means that a substance newly introduced on the market cannot be placed in Category 1. To place a substance into the Categories 2 and 3 animals studies must deliver information on impaired fertility or developmental toxic effects.[38]

Table 14: EU Classification of Substances Toxic to Reproduction

| Category | Description | Symbol & Risk Phrases |
|---|---|---|
| Category 1 | 1. Substances known to impair fertility in humans.<br>2. Substances known to cause developmental toxicity in humans. | T; R60: May impair fertility.<br>T; R61: May cause harm to the unborn child. |
| Category 2 | 1. Substances which should be regarded as if they impair fertility in humans.<br>2. Substances which should be regarded as if they cause developmental toxicity to humans. | T; R60: May impair fertility.<br>T; R61: May cause harm to the unborn child. |

| Table 14: (continued) EU Classification of Substances Toxic to Reproduction | | |
|---|---|---|
| Category 3 | 1. Substances which cause concern for human fertility.<br>2. Substances which cause concern for humans owing to possible developmental toxic effects. | Xn; R62: Possible risk of impaired fertility.<br>Xn; R63: Possible risk of harm to the unborn child. |

### 9. 4. 4 Chronic Toxicity - Acceptable Daily Intake (WHO/FAO)

In absence of an international classification system for chronic toxicity, the acceptable daily intake (ADI) is used in this study as a measurement for chronic toxicity.

The acceptable daily intake (ADI) has been developed to assess chronic hazards posed by pesticide residues. It is the assumed amount a human can consume on a daily basis without causing damages to health. The ADI is assigned by the Joint FAO/WHO Meeting on Pesticide Residues (JMPR) on the basis of an examination of available information, including data on the biochemical, metabolic, pharmacological, and toxicological properties of the pesticide extracted from studies of experimental animals and observations in humans. Used as the starting-point is the no-observed-adverse-effect level (NOAEL) for the most sensitive toxicological parameter, usually in the most sensitive species of experimental animal. To take into account the type of effect, the severity or reversibility of the effect, and the problems of inter- and intraspecies variability, a safety factor is applied to the NOAEL to determine the ADI for humans.[39]

The ADI values can be found in Appendix 2. For 86 of the valuated pesticides an ADI value has been assigned.[40]

38 European Union (1993): Council Directive 93/21/EEC of 27 April 1993 adapting to technical progress for the 18th time Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

39 Global Environment Monitoring System – Food Contamination Monitoring and Assessment Programme (GEMS/Food) and Codex Committee on Pesticide Residues (1997): Guidelines for Predicting Dietary Intake of Pesticide Residues, WHO/FSF/FOS/97.7, Programme of Food Safety and Food Aid (FAO), World Health Organization (WHO)

40 World Health Organisation/ International Programme on Chemical Safety (2000): Inventory of IPCS and other WHO pesticide evaluation and summary of toxicological evaluations performed by the Joint Meeting on Pesticide Residues (JMPR) through 2000, WHO/IPCS, Vienne, Switzerland

**Resources to human toxicology of pesticides and chemicals:**

IPCS INCHEM is a means of rapid access to internationally peer reviewed information on chemicals commonly used throughout the world, which may also occur as contaminants in the environment and food. The homepage links to the IARC and the WHO classifications, to the International Chemical Safety Cards (ICSCs) and to the JMPR (Joint Meeting on Pesticide Residues) - monographs and evaluations: www.inchem.org

Online database maintained by Pesticide Action Network North America. World wide the most comprehensive online database on pesticides: www.pesticideinfo.org

European Chemical Bureau responsible for Directive 67/548EC and 99/44EC as well as for biocides. http://ecb.jrc.it Classification of substances in Annex I of Directive 67/548EC is online available under: N-CLASS Database on Environmental Hazard Classification

PAN United Kingdom briefing papers cover pesticides and health, pesticides around us, controver pesticides, pesticides and farming & pesticides in food. Briefings regarding pesticides and health: The List of Lists; Background Papers; Unsafe sex: how endocrine disruptors work available under: http://www.pan-uk.org

The California Department of Pesticide Regulation (DPR) website lists some 386 chemicals and allows access to Toxicology Data Review Summaries in form of Acrobat Reader pdf files:

www.cdpr.ca.gov/docs/toxsums/toxsumlist.htm

Health and Safety information has been collected on over 2000 chemicals studied by the U.S. National Toxicology Program: http://ntp-server.niehs.nih.gov/default.html

Recognition and Management of Pesticide Poisoning is published by U.S. EPA's Office of Pesticide Programs. Explains the mode of action of common pesticide groups and treatment possibilities: www.epa.gov/pesticides/safety/healthcare/handbook/handbook.htm, the homepage of the U.S. EPA's Office of Pesticide Program offers a large amount scientific and general information: www.epa.gov/pesticides

Communication from the European Commission to the Council and the European Parliament on the implementation of the Community Strategy for Endocrine Disrupters, website of DG Environment: http://europa.eu.int/comm/environment/docum/01262_en.htm

Selected world wide web resources on endocrine disruptors maintained by the National Resources Defence Council (NRDC): www.nrdc.org/health/effects/bendres.asp

Endocrine disruptor web site of U.S. EPA: www.epa.gov/scipoly/oscpendo/index.htm

Complete online book “Hormonally Active Agents in the Environment” (2000), 430 pages:

www.nap.edu/books/0309064198/html

Our Stolen Future - the leading work on the emerging scientific knowledge about hormone disruption: www.ourstolenfuture.com

# 10 Endocrine Disruption

The issue of endocrine (hormone) disrupting effects of pesticides is a relatively new subject. Therefore there are no confirmed lists of pesticides with endocrine disrupting properties on an official national or international (e.g. WHO, EU) level. Only in the last ten years this issue has been addressed more intensively by a wide range of scientists in several organisations. It is important to notice that not even the endocrine system of the human body is fully understood, therefore the range of effects hormone mimicking or blocking chemicals may cause cannot yet be fully understood. This chapter attempts to summarise aspects of the existing knowledge on endocrine disrupting effects on humans and the environment.

In the human body two communication systems exist which regulate all responses and functions of the body: the endocrine system and the nervous system. The endocrine system functions through chemical messengers (hormones) which are produced by glands, whereas the nervous system functions through electrochemical messengers running along certain pathways to the brain and back to the peripheral nervous system. Hormones composed by the endocrine system instruct body cells more subtly and slowly than the messengers sent over the nervous system. There are several features of the endocrine system which make it a) very complex and complicated to understand, and b) susceptible to chemical input from the outside world. Hormones are specific, slow-acting chemical messengers which travel through the bloodstream and encounter special receptors.[41] Their effects usually continue in the body for long periods of time. The 'specific' nature of hormones is a particularly striking feature: this means that a hormone fits into a particular receptor, precisely as a key fits only the lock it is made for. This simple description is only a symbol. It does not depict the reality that, while many keys may fit into the lock, not all of them induce the appropriate effect, but may instead block the receptor.[42] However, the specification does not exclude a certain flexibility. A specific receptor can be present on different kinds of cells in different organs of the body, which means that a hormone which belongs to this receptor can be used by the body to achieve different effects in different tissues.[43] Hormones are responsible for the regulation of a large range of human activities and functions, including mutations in DNA nucleotides, biorhythm, mood, concentration of blood calcium and blood sugar, development of secondary sex characteristics and functioning of sex organs. Since certain hormones can alter gene expression and play important roles in regulating the growth and differentiation of cells, they are also involved in carcinogenesis. This is experimentally proven in cases of prostate and breast cancer. Possibilities of environmental contamination are of great concern, in that the introduction of very small amounts of chemicals can significantly effect hormones which play such an important part in the functioning of our bodies.

Most research dealing with endocrine disrupting chemicals has either been done on the alterations of reproductive organs or on the connection between cancer and hormones. As previously explained, hormones work with a kind of lock-key scheme and this is where environmental contaminants come into play. They may mimic other hormones, which means that there are suddenly "fake" hormones in the body which have not been induced by signals

41 McLachlan, J.A., Arnold, S.F.,(1996): Environmental Estrogens, American Scientist, accessible through http://www.amsci.org/amsci/articles/96articles/McLachla.html

42 Eubanks, M. W. (1997): Environmental Health Perspectives Volume 105, Number 5, National Institute Environmental Health Sciences (NIEHS), USA

43 ibid 41

from endocrine glands and which subsequently log on to the receptors and stimulate an effect. What puzzles scientists is the fact that chemicals which mimic hormones do not necessarily resemble the chemical structure of the hormone. Blocking a hormone from inducing an effect is another way environmental contaminants can act.

There is evidence that certain pesticides are endocrine disruptors, for example the organochlorine POPs pesticides DDT, dieldrin, toxaphene and chlordane, mirex, and endosulfan.26 These pesticides act as estrogens and can alter the sex organs and/or induce cancer. The high hazard potential of endocrine disrupting chemicals has been demonstrated in lab experiments, by incidents of contamination in wildlife, and by pesticide accidents. After exposure to estrogenic pollutants an effect called 'feminisation' occurred in wildlife: fish species and amphibia which were exposed developed more female offspring than usual, and experiments showed that eggs (turtle eggs in this case) exposed to estrogens only develop female offspring. As a result of an accident with Kepone (synonym chlordecone), exposed men had a lower sperm count. The dramatic decrease in sperm count in men all over the world may be due to unintentional exposure to endocrine disrupting chemicals.[44]

Unintentional endocrine disruption is a subtle and largely unknown process the symptoms of which may be apparent only decades later in humans and wildlife. Scientists all over the world have been alerted to these possible adverse effects.

In 2000, the European Union published a study: *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*.[45] In this study 564 substances were reviewed concerning their potential endocrine disrupting properties. The expert meeting created a list of 147 substances with endocrine disruption classifications. The expert also looked at the persistence of the substances and the exposure concern to those 147, which have been categorised. Appendix 3 list all ingredients authorized in Slovenia, which have been reviewed by the EU, as well as those reviewed by other scientists.

Appendix 3 lists the ingredients authorized in Slovenia and their potential to disrupt the endocrine system. In absence of existing official national or international sources, this list was compiled from other sources. So far only 61 ingredients are listed in Appendix 3. This low number does not mean that all other substances have no potential to act as endcrine disruptors, it reflects the small number of reviewed chemicals in general.

The issue of endocrine disruption extends the scope of this study by far. For further reading a short list of references is included in Appendix 3.

44 ibid 41

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

# 11 Environmental Toxicity

*99 ingredients authorized in Slovenia are classified as "Dangerous for the Environment" and 94 have been assigned with the Symbol "N."*

Pesticides can be released into the environment in many ways. Through run-off from fields they make their way into ditches, rivers, lakes. Ultimately, they reach the oceans through the water cycle. They may also leach into groundwater, which is then discharged into streams or is subsequently used for irrigation. Drift, evaporation and precipitation carry pesticides into both, nearby and far habitats. Via the foodchain accumulated in animal tissue, they can travel far distances and arrive at places in which they were never applied. Entire ecosystems are effected by the use of pesticide. Birds, mammals, insects and all other living creatures are poisoned either directly or indirectly by feeding upon poisoned food. They also experience reductions in food supply and habitat for both, themselves and their prey due to the extensive use of pesticides. Pesticides have always been created to do harm, and the chemical input into the environment is more pervasive and insidious than any other impact humans have had on their habitat. The fate and functioning of chemicals in the environment is still unknown to a great extent. The occurrence of multiple chemicals and their reactions with each other is another serious gap in the knowledge of modern science. Environmental symptoms such as a shift in sex ratios, cancer in wildlife animals, impaired fertility and/or other physical abnormalities can barely be explained at the current stage of scientific knowledge.[46] The few toxicity tests implemented for the pesticide registration process such as testing of the lethal concentration to certain fish species or waterfleas do not mimic reality at all. The following chapters present different approaches to assess the environmental impact of pesticides. The effects of endocrine disruption were already addressed separately in Chapter 10 because it effects human health as well as the environmental.

The summarised listings and categories of pesticide authorized in Slovenia can be found in Appendix 4. A number of pesticide ingredients were excluded from the evaluation list, these are beneficial organism, inorganic compounds such as boric acid and ammonia, unclassified substances such as vegetable oil, waxes, glue, garlic, unclassified repellents, all adjuvants and all botanicals. Altogether 75 substances were excluded. The exclusion was done because toxicity information for most of these compound is not available.

## 11. 1 Classification of the European Union

### 11. 1. 1 Aquatic Environment

The major legislative framework in force dealing with dangerous substances in the European Union is the Council Directive 67/548/EEC of 27 June 1967, on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.[47] The classification of dangerous substances regarding their environmental hazards can be found in the amendment paper 393L002131[48] (Commission Directive 93/21/EEC of 27 April 1993), a modification to the directive 67/548/ EEC. The present criteria of

46 Kegley, S., Neumeister, L., Martin, T., (1999): Disrupting the Balance, Ecological Impacts of Pesticides in California, Pesticide Action Network North America, Californians for Pesticide Reform, San Francisco, USA

47 European Union (1967): Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal 196, Brussels, Belgium

this classification refer to aquatic ecosystems, but it is acknowledged that certain substances may affect other ecosystems as well. Table 15 displays the classification and the applied risk phrases valid in the European Union. The tests, on which this evaluation is based, are described in Annex V of the Directive 67/548 EEC. Amendments and modifications to this Annex were added and they can be found in separate documents. Comments on the determination of certain effects can be looked up in Document 393L0021.

Table 15:EU Classification: “Dangerous for the Environment” (aquatic)

| Symbol | Acute Toxicity | | | Risk Phrase |
|---|---|---|---|---|
| | Fish $LC_{50}$[a], mg/L, 96h | Daphnia $LC_{50}$[b], mg/L, 96h | Algae $IC_{50}$[c], mg/L 72h | |
| N | 1 | 1 | 1 | R50 |
| N | 1 | 1 | 1 | R50/53 |
| N | 1 ≥ 10 | 1 ≥ 10 | 1 ≥ 10 | R51/53 |
| - | 10 ≥100 | 10 ≥100 | 10 ≥100 | R52/53 |
| - | - | - | - | R52 |

a. The $LC_{50}$ = lethal concentration is defined as the amount of pesticide present per liter of aqueous solution that is lethal to 50% of the test organisms within the stated study time. Units are mg or µg of pesticide per liter of solution. Equivalent units are ppm (mg/L) and ppb (µg/L).
b. The $EC_{50}$ = effective concentration of the pesticide in mg/L or µg/L that produces a specific measurable effect in 50% of the test organisms within the stated study time. The measurable effect is lethality for zooplankton and a reduction in photosynthetic activity by 50% for phytoplankton.
c. The $IC_{50}$ = inhibitive concentration of the pesticide defined as the amount of pesticide present per liter of a solution that inhibits the growth of a algae culture by 50% within the stated study time.

R50: Very toxic to aquatic organisms
R51: Toxic to aquatic organisms
R52: Harmful to aquatic organisms
R53: May cause long-term adverse effects in the aquatic environment
Combined Risk Phrases should be read with a ‘comma’ between the phrases, as in R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

For aquatic organisms tests are carried out using either static or flow-through methods. In the static method, the pesticide and test organisms are added to the test solution and kept there for the remainder of the experiment. In the flow-through method, a freshly prepared, pesticide-spiked test solution flows through the test chamber continuously for the duration of the test. The flow-through method provides a higher continuous dose of the pesticide; however, the static method does not remove waste products and may accumulate toxic breakdown products. Neither method exactly mimics a natural system. The EU recommends in Document 398L0073[49]

48 European Union (1993): Document 393L0021, Council Directive 93/21/EEC of 27 April 1993 adapting to technical progress for the 18th time Council Directive 67/548/EEC on the approximation of laws, reg lations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

49 Europäische Gemeinschaft (1998): Dokument 398L0073, Richtlinie 98/73/EG der Kommission vom 18. September 1998 zur vierundzwanzigsten Anpassung der Richtlinie 67/548/EWG des Rates zur Angleichung der Rechts- und Verwaltungsvorschriften für die Einstufung, Verpackung und Kennzeichnung gefährlicher Stoffe an den technischen Fortschritt, Amtsblatt Nr. L 305 vom 16/11/1998, EG, Brüssel, Belgien

from 1998 the flow-through method for fish according to the test method of the Organisation for Economic Co-operation and Development (OECD) TG 305, but also approves data from other test methods. For *daphnia* species (preferred *Daphnia magn*a, but *Daphnia pulex* is also possible) and algae (*Selenastrum capricornutum* and *Scenedesmus subspicatus*), the static method should apply. The Risk Phrase “R53: May cause long-term adverse effects in the aquatic environment” is applied to substances which are not readily degraded and therefore pose a long time threat to the environment. The test methods are described in Document 392L0069[50] 17th amendment of Directive 67/548 EEC. Please note that the test method for fish from Document 398L0073 replaces the test method from Document 392L0069.

The EU Symbols and Risk Phrases of the ingredients authorized in Slovenia can be found in Appendix 4.

### 11. 1. 2 Terrestrial Environment

The EC also classifies substances according to the dangers they pose to environments other than the aquatic environment. If one of the following Risk Phrases apply to a substance the Symbol “N” for “Dangerous for the Environment” is to assign:

R54: Toxic to flora
R55: Toxic to fauna
R56: Toxic to soil organisms
R57: Toxic to bees
R58: May cause long-term adverse effects in the environment
R59: Dangerous for the ozone layer.

The EC does not require testing for those criteria and test methods have not been described in Document 392L0069. Document 393L0021 simply states that this classification is applicable when available evidence shows that pesticides may present a danger for ecosystems and that the criteria will be elaborated later. Classifying a substance as R59 occurs whether or not the substance is listed in Annex I Group I, II, III, IV and V to Council Regulation (EEC) No. 594/91 on substances that deplete the ozone layer.[51]

## 11. 2 Environmental Impact Evaluation by Cornell University

The IPM Programme of Cornell University (New York) has developed an elaborated approach to assess the impact of pesticides and pest management practises on the environment. Information on physical properties, toxicities and environmental fate were gathered to develop a model called the Environmental Impact Quotient (EIQ). The equation used in calculating the EIQ is based upon the three components of agricultural production systems: a farm worker component, a consumer component, and an ecological component.[52]

50 Europäische Gemeinschaft (1992): Dokument 392L0069, Richtlinie 92/69/EWG der Kommission vom 31. Juli 1992 zur siebzehnten Anpassung der Richtlinie 67/548/EWG des Rates zur Angleichung der Rechts- und Verwaltungsvorschriften für die Einstufung, Verpackung und Kennzeichnung gefährlicher Stoffe an den technischen Fortschritt Amtsblatt nr. L 383 vom 29/12/1992, EG, Brüssel, Belgien

51 European Union (1993): Document 393L0021, Council Directive 93/21/EEC of 27 April 1993 adapting to technical progress for the 18th time Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

Please note all documents are available in multiple languages on the EC website; the prefix determines the document language e.g. en_392L0069.html, de_392L0069.html

Since the health hazards of the pesticides authorized in Slovenia have already been described in the Chapter Human Toxicity, only the ecological component of the EIQ model will be used in this study. The EIQ model is built using a rating system: for each pesticide, parameter values between 1 to 5 according to the properties of the pesticide have been assigned. Low values mean low impact, high values the opposite. The parameter, the applied rating system and the main data sources are displayed in Table 16.

Table 16: Rating System for the Environmental Impact Quotient

| Parameter | Rating System | Data Source |
|---|---|---|
| Mode of Action | non-systemic 1<br>all herbicides 1<br>systemic 3 | EXTOXNET, CHEM-NEWS |
| Acute Dermal $LD_{50}$ for Rabbits/ Rats | > 2000 1<br>200 - 2000 3<br>200 - 5 5 | EXTOXNET, CHEM-NEWS |
| Long-Term Health Effects | little or none 1<br>possible 3<br>definite 5 | EXTOXNET, CHEM-NEWS |
| Plant Surface Residue Half-life | I -2 weeks 1<br>2 - 4 weeks 3<br>> 4 weeks 5<br>pre-emergent herbicides 1<br>post-emergent herbicides 3 | EXTOXNET, CHEM-NEWS |
| Soil Residue Half-life | < 30 days 1<br>30 - 100 days 3<br>> 100 days 5 | USDA Agricultural Research Service and Soil Conservation Service |
| Toxicity to Fish-96 hr $LC_{50}$ | > 10 mg/l 1<br>1 - 10 mg/l 3<br>< 1 mg/l 5 | EXTOXNET, CHEM-NEWS |
| Toxicity to Birds-8 day $LC_{50}$ | > 1000 mg/l 1<br>100 - 1000 mg/l 3<br>1 - 100 mg/l 5 | EXTOXNET, CHEM-NEWS |
| Toxicity to Bees | relatively nontoxic 1<br>moderately toxic 3<br>highly toxic 5 | New York State Pesticide Recommendations |
| Toxicity to Beneficials | low impact 1<br>moderate impact 3<br>severe impact 5 | SELCTV (Oregon State) |
| Groundwater and Runoff Potential | small 1<br>medium 3 | USDA Agricultural Research Service and Soil Conservation Service |

52 IPM Programme, Cornell University, New York State Agricultural Experiment Station Geneva (1999):A Method to Measure the Environmental Impact of Pesticides, accessible through http://www.nysaes.cornell.edu/ipmnet/ny/Programme_news/EIQ.html, New York, USA

| Table 16: (continued) Rating System for the Environmental Impact Quotient | | |
|---|---|---|
| Parameter | Rating System | Data Source |
| | large 5 | |

Within the components, individual factors are weighted differently. To give additional weight to individual factors, coefficients are used based on a one to five scale. Factors with the most weight are multiplied times five, medium-impact factors are multiplied times three and least-impact factors are multiplied times one. The exposure potential is expressed through factors as well, for example, fish toxicity is calculated by determining the toxicity of the pesticide to fish, times the probability (runoff potential) of the fish undergoing exposure to the pesticide.

Even when this model is quite comprehensive and closer to the real-life situation than other approaches to environmental assessment, there are a few inherent weaknesses: toxicities of algae and zooplankton, critical elements of the aquatic environment, have been left out; acute toxicity to mammals is only expressed as dermal $LD_{50,}$ (exposure through the skin) ; and toxicity to birds only as $LC_{50}$ (lethal concentration). The last point is especially critical, since direct ingestion of contaminated food or granular forms of pesticides is often responsible for larger bird kills.[53] Potential endocrine disrupting effects have been left out in the model as well.

For 97 ingredients authorized in Slovenia the ecological impact according to the model of Cornell University has been calculated. The list of the ingredients authorized in Slovenia and their evaluation by Cornell University can be found in Appendix 4. The insecticides *propoxur, methamidophos, dimethoate, methidathion and esfenvalerate* are the pesticides with the highest ecological impact due to their high toxicity on bees, birds and beneficial organisms.

**Resources to pesticides and environment:**

Online database maintained by Pesticide Action Network North America. World wide the mos comprehensive online database on pesticides: www.pesticideinfo.org

European Chemical Bureau responsible for Directive 67/548EC and 99/44EC as well as for bi cides. http://ecb.jrc.it Classification of substances in Annex I of Directive 67/548EC is online available under: N-CLASS Database on Environmental Hazard Classification

The U.S. EPA ECOTOX database provides single chemical toxicity information for aquatic ar terrestrial life. ECOTOX is a useful tool for examining impacts of chemicals on the environmer www.epa.gov/ecotox

The EXTension TOXicology NETwork (EXTOXNET) is an effort of University of California, Da is, Oregon State University, Michigan State University, Cornell University, and the University Idaho. Pesticide Information Profiles (PIPs) are documents which provide specific pesticide i formation relating to health and environmental effects:

http://ace.orst.edu/info/extoxnet

USGS Toxic Substances Hydrology Program provides objective scientific information to improve characterization and management of contaminated sites, to protect human and enviro mental health, and to reduce potential future contamination problems: http://toxics.usgs.gov/

53 Kegley, S., Neumeister, L., Martin, T., (1999): Disrupting the Balance, Ecological Impacts of Pesticides in California, Pesticide Action Network North America, Californians for Pesticide Reform, San Francisco, USA

# 12 Pesticides in Food and Water

Residue data are used in order to estimate the environmental and human exposure to pesticides. In absence of Polish monitoring data, German data were used in this study. The collection of German residue data resulted in a list of 149 different pesticides detected in Germany. 87 of these pesticides are also authorized in Slovenia and may, under similiar conditions, also cause residues in Polish food and waters.

Data on German pesticide residues in food were obtained from the German Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV). The BgVV started its current monitoring programme in 1995, based upon a 'Foodstuff Basket' which represents the entire food market in Germany. Every year until 2001 a new fraction of this 'Foodstuff Basket' has been analysed. According to a monitoring plan, approximately 4600 samples (domestic and foreign) are analysed each year by the federal states. The BgVV collects the data annually from the federal states and publishes them in the internet[54] and as hard copies.

The BgVV analyses different substances in different foodstuffs. Food with animal origin is tested for heavy metals, persistent organochlorine compounds (DDT and its metabolites, Dieldrin, Endrin, HCH etc.), PCB, moschus compounds and bromocycles. Food with plant origin is tested for pesticides, myco toxins, nitrate and plant surface treatment substances and heavy metals.

There are several criteria by which the BgVV chooses the pesticides to be determined:

- registration status
- acceptable daily intake (ADI) according to the World Health Organisation (WHO)
- experience
- maximum residue level (MRL)
- applicability of multiresidue method S 19, a detection method commonly used in Germany

Only data from samples with plant origin and with origin in Germany were included in the data collection. The latest data available are from the year 2000. Monitoring data from the year 1997 through 2000, in this time span 26 food stuffs e.g. crops were monitored.

Only samples with quantifiable detections were considered. The concentration of a detected residue relates to several factors, e.g. the time span between the sampling and the last application of the pesticide, the chemical and physical properties of the pesticide, the weather conditions after the application, but less to the amount applied. Information on the quantity was therefore neglected. The number of detections of a pesticide was also not considered, because the monitoring data only represent a small number of relative randomly taken foodstuffs. This means that all quantifiable pesticide residues, independent of amount and number, were used in this study. Myco toxins, nitrat and plant surface treatment substances as well as heavy metals were excluded.

## Groundwater

The Federal Working Group on Water (LAWA) collects data on water quality from all federal states and publishes them. The last report on pesticides in the groundwater was published in 1997 and contains data from the time span 1990 through 1995.[55] Those data were considered

54 Website of the BgVV: http://www.BgVV.de/fbs/fb1/lebensmittel/monitor.htm

outdated, therefore the responsible federal state agencies were contacted and recent data were requested. The following states (out of 16) submitted recent data:

- Niedersachen (1997- 1998)
- Sachen-Anhalt (1997-1999)
- Sachsen (1997-1999)
- Schleswig-Holstein (1997-1999)
- Berlin[56] (1997 -2001)
- Bremen (1999)
- Nordrhein-Westfalen (1997-2001)
- Hamburg (1998, 1999)
- Bavaria (2000)

The concentration of residues in groundwater relates to several factors, for example the time span between the sampling and the last application of the pesticide, the amounts applied, soil structure (biological activity, structure), precipitation and the environmental behaviour of the substance. Therefore, information on the concentration was neglected. Any residue reported to be found in groundwater was used in this study.

### Surface Water

There are several organisations, which sample pesticides in surface water. Federal states which have big streams in their area usually monitor pesticides on a regular schedule and publish Water Quality Reports. Some of those Water Quality Reports include CD ROMs with databases, some exist as hardcopy versions. Water Quality Reports from Nordrhein-Westfalen, Baden-Württemberg and Rheinland-Pfalz were obtained to get information on pesticides in the river Rhine. Data on pesticides in the river Elbe were obtained from the Working Group for a Clean Elbe (ARGE). Data on pesticides in the river Weser were obtained from the Working Group for a Clean Weser. Those working groups are founded and maintained by institutions of the federal states, which are concerned with the water quality in these rivers.

Additionally, all federal states were contacted and asked to submit data.

Appendix 5 lists 78 pesticides detected as residues in German food and water, which are authorized as pesticide in Slovenia.

## 12. 1 Limits of Monitoring Data

Monitoring data are a valuable source of information. However, there are a number of factors, which make the assessment of residue data difficult:

- monitoring programmes can only detect the pesticides which are looked for,
- in general, sampling in Germany does not correlate with the time of application and does not relate to the amounts of pesticides actually applied,
- the detected concentration depends on the time span between sampling and application,

55 Länderarbeitsgemeinschaft Wasser (1997): Bericht zur Grundwasserbeschaffenheit - Pflanzenschutzmittel -, Kulturbuchverlag Berlin GmbH, Berlin, Germany

56 Only very few pesticides were tested, mostly organochlorines.

- water monitoring programmes differ considerably from state to state.

Other major data gaps are related to the detection methods, which:

- do not cover all pesticides in food due to inexpensive and practical multi method technologies,
- are very expensive for some substances and therefore not used on a larger scale,1[57]
- typically extract only 30-90% of the residues present,[58]
- do not cover all breakdown products,
- do not cover 'inert' ingredients,[59] and
- may vary from year to year due to improved technologies, that can detect lower concentrations.

Actual pesticide use data are needed to develop targeted monitoring programme, and to evaluate pesticide use. In the US. States California and Oregon, any application of a pesticide with commercial intention has to be reported to governmental agencies. California use data have been used for a wide variety of purposes. A thorough analysis of the pesticide use reporting (PUR) systems in California and Oregon was published by PAN Germany in January 2002.[60] This report shows how pesticide use data are utilised for the analysis of trends and statistics by crop, region, ingredient and product. They are also used for the protection of ground and surface water, for risk assessment, for epidemiological studies and for the evaluation of pest management practices. A proceeding study published by PAN Germany in June 2002, presents and discusses options and possibilities for pesticide use reporting (PUR) systems in the European Union.[61]

**Resources to pesticide residues in food:**

European Commission website presents result of national monitoring programme:

http://europa.eu.int/comm/food/fs/ph_ps/pest/index_en.htm

The European Commission operates an EU Rapid Alert System for Food. This provides the information on cases where high residues of pesticides have been found in imported samples: http://www.pesticides.gov.uk/citizen/residues/other/other_residues.htm

57 Personal communication with Dr. Domroese, Environmental Agency of Hamburg

58 Kegley, S. E., Neumeister, L., Martin, T., (1999): Disrupting the Balance, Ecological Impacts of Pesticides in California, Pesticide Action Network North America, Californians for Pesticide Reform, San Francisco, USA

59 Pesticide products contain active and 'inert' ingredients, which are substances which can enhance the efficiency of the active ingredient, make a product more degradable or easier to use. 'Inerts' are mostly handled as trade secrets of the manufacturer which means they are not labelled on the product.

60 Neumeister, L. (2002): Pesticide Use Reporting - Legal Framework, Data Processing and Utilisation, Part One Full Reporting Systems in California and Oregon, Pesticide Action Network Germany, Hamburg, Germany

61 Neumeister, L. (2003): Pesticide Use Reporting - Options and Possibilities for Europe, Pesticide Action Network Germany, Hamburg, Germany

# 13 Summary

Agriculture in Slovenia is characterised by small farms and production of livestock and specialty crops. Narrow crop rotation on the arable land leads already to increased environmental problems. Agricultural development, especially the intensification of fruit and vegetable growing suggests that pesticide use will increase in the future. On the other hand, the Slovenian agri-environment programme is very well developed and bears potential to solve environmental problem caused by agriculture. Organic agriculture is on the rise and this trend will probably continue due to better marketing and continued governmental support.

Due to the fact that data on pesticide use by crop and active ingredients are not available a trend analysis cannot be made.

In the year 2000 some 240 pesticide active ingredients, plant growth regulators and other substance used in crop protection were registered in Slovenia. The evaluation of these substances according to international classification system showed that:

- 99 ingredients authorized in 2000 in Slovenia are classified as “Dangerous for the Environment” and 83 have been assigned with the Symbol “N”;
- 17 of the ingredients authorized in Slovenia cause concern for humans due to possible carcinogenic effects and have been placed into the carcinogenicity category 3 by the EU. 6 cause concern for humans owing to possible mutagenic effects and have been placed into the mutagenicity category 3. 3 may cause harm to the unborn child, 7 present possible risks of harm to the unborn child, 2 may impair fertility, 2 present possible risk sof impaired fertility and 1 may cause harm to breast-fed babies;
- 23 of the ingredients authorized in Slovenia are evaluated by the IARC: 7 as possibly carcinogenic to humans. 16 are considered as not classifiable as carcinogenic to humans;
- 128 of the ingredients authorized in Slovenia are classified by the European Union: 18 as very toxic, 22 as toxic, 63 as harmful and 11 as irritant;
- 26 of the ingredients authorized in Slovenia are cholinesterase inhibitors (ChE);
- 11 substances are priority substances according to the European Water Framework Directive;
- 4 are PIC pesticides or PIC candidates;

With accession to the European Union in 2004 and in compliance with EU Directive 91/414 EC authorization for 31 active ingredients will expire in Slovenia.

## Appendix 1 - Identification and Regulatory Status

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| dinocap | 39300-45-3 | 254-408-0 | 98 | AC, FU | Dinitrophenol derivative | pending | | |
| propineb | 12071-83-9 | | 177 | AC, FU | Dithiocarbamate | | | |
| abamectin | 65195-55-3 | | | AC, IN | Botanical | | | |
| acrinathrin | 101007-06-1 | | 8003 | AC, IN | Pyrethroid | Notified | | |
| amitraz | 33089-61-1 | 251-375-4 | 362 | AC, IN | Formamidine | pending | | |
| bromopropylate | 18181-80-1 | | 503 | AC, IN | Unclassified | Out 7/03 | | |
| clofentezine | 74115-24-5 | | 418 | AC, IN | Unclassified | Notified | | |
| cyhexatin | 13121-70-5 | 236-049-1 | 289 | AC, IN | Organotin | Notified | | |
| dichlorvos, DDVP | 62-73-7 | 200-547-7 | 11 | AC, IN | Organophosphorus | Notified | | |
| endosulfan | 115-29-7 | 204-079-4 | 89 | AC, IN | Organochlorine | pending | PD | |
| fenazaquin | 120928-09-8 | 410-580-0 | 8149 | AC, IN | Unclassified | Notified | | |
| lambda-cyhalothrin | 91465-08-6 | 415-130-7 | 463 | AC, IN | Pyrethroid | Annex I | | |
| malathion | 121-75-5 | 204-497-7 | 12 | AC, IN | Organophosphorus | Notified | | |
| parathion | 56-38-2 | 200-271-7 | 10 | AC, IN | Organophosphorus | pending | | Yes |
| permethrin | 52645-53-1 | 258-067-9 | 331 | AC, IN | Pyrethroid | out 12/03 | | |
| pirimiphos-methyl | 29232-93-7 | 249-528-5 | 239 | AC, IN | Organophosphorus | Notified | | |
| propargite | 2312-35-8 | 219-006-1 | 216 | AC, IN | Unclassified | Notified | | |
| tetradifon | 116-29-0 | | 113 | AC, IN | Unclassified | Notified | | |
| methiocarb | 2032-65-7 | 217-991-2 | 165 | AC, IN, MO | N-Methyl Carbamate | Notified | | |
| phosalone | 2310-17-0 | 218-996-2 | 109 | AC,IN | Organophosphorus | Notified | | |
| copper hydroxide | 20427-59-2 | | 8074 | BA, FU | Inorganic-Copper | Notified | | |
| copper oxychloride | 1332-40-7 | | 8076 | BA, FU | Inorganic-Copper | Notified | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| copper sulfate | 7758-99-8 | | | BA, FU | Inorganic-Copper | | | |
| azoxystrobin | 131860-33-8 | | 571 | FU | Strobin | Annex I, new ai | | |
| benalaxyl | 71626-11-4 | | 416 | FU | Xylylalanine | pending | | |
| benomyl | 17804-35-2 | 241-775-7 | 206 | FU | Benzimidazole | Out5/03 | | |
| bitertanol | 55179-31-2 | | 386 | FU | Azole | Notified | | |
| captan | 133-06-2 | 205-087-0 | 40 | FU | Thiophthalimide | Notified | | |
| carbendazim | 10605-21-7 | 234-232-0 | 263 | FU | Benzimidazole | pending | | |
| carboxin | 5234-68-4 | | 273 | FU | Carboxamide | Notified | | |
| copper sulfate (basic) | 1344-73-6 | | | FU | Inorganic-Copper | | | |
| cymoxanil | 57966-95-7 | 261-043-0 | 419 | FU | Unclassified | Notified | | |
| cyprodinil | 121552-61-2 | | 511 | FU | Unclassified | Notified | | |
| dichlofluanid | 1085-98-9 | 214-118-7 | 74 | FU | Unclassified | Out 7/03 | | |
| difenoconazole | 119446-68-3 | | 8107 | FU | Azole | Notified | | |
| dimethomorph | 110488-70-5 | 404-200-2 | 483 | FU | Morpholine | Notified | | |
| diniconazole | 83657-18-5 | | 8117 | FU | Azole | Notified | | |
| dithianon | 3347-22-6 | 222-098-6 | 153 | FU | Unclassified | Notified | | |
| dodine | 2439-10-3 | 219-459-5 | 101 | FU | Guanidine | Notified | | |
| epoxiconazole | 106325-08-0 | 406-850-2 | 609 | FU | Unclassified | Notified | | |
| famoxadone | 131807-57-3 | | | FU | Unclassified | new ai, prov. until 18.4.2002 | | |
| fenarimol | 60168-88-9 | 262-095-7 | 380 | FU | Pyrimidine | pending | | |
| fenbuconazol | 114369-43-6 | 406-140-2 | 8150 | FU | Azole | Notified | | |
| fenhexamid | 126833-17-8 | | | FU | Unclassified | Annex I, new ai | | |
| fenpropimorph | 67564-91-4 | 266-719-9 | 427 | FU | Morpholine | Notified | | |
| fentin acetate | 900-95-8 | 212-984-0 | 489 | FU | Organotin | out12/02 | | |
| fentin-hydroxid | 76-87-9 | 200-990-6 | 490 | FU | Organotin | out12/02 | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| fludioxonil | 131341-86-1 | | 522 | FU | Unclassified | Notified | | |
| fluquinconazol | 136426-54-5 | 411-960-9 | 474 | FU | Azole | Notified | | |
| flutriafol | 76674-21-0 | | 436 | FU | Azole | Notified | | |
| folpet | 133-07-3 | 205-088-6 | 75 | FU | Thiophthalimide | Notified | | |
| fosetyl-al | 39148-24-8 | | 384 | FU | Unclassified | Notified | | |
| guazatine | 13516-27-3 | | 531 | FU | Guanidine | Out 7/03 | | |
| hexaconazole | 79983-71-4 | | 465 | FU | Azole | Notified | | |
| iprodione | 36734-19-7 | 253-178-9 | 278 | FU | Dicarboximide | Annex I | | |
| kresoxim-methyl | 143390-89-0 | | 568 | FU | Strobin | Annex I, new ai | | |
| lecithin | 8002-43-5 | | 8201 | FU | Botanical | | | |
| mancozeb | 8018-01-7 | | 34 | FU | Dithiocarbamate | pending | | |
| metalaxyl | 57837-19-1 | | 365 | FU | Xylylalanine | pending | | |
| metalaxyl-m | 70630-17-0 | | | FU | Xylylalanine | new ai, prov. until 12.3.2002 | | |
| metiram | 9006-42-2 | | 478 | FU | Dithiocarbamate | pending | | |
| myclobutanil | 88671-89-0 | | 442 | FU | Azole | Notified | | |
| ofurace ((2 chloro-n-[2,6-dimethylphenyl-n-tetrahyro-20x0-3- furanyl] aceta-mide)) | 58810-48-3 | | 444 | FU | Anilide | Out 7/03 | | |
| penconazol | 66246-88-6 | | 446 | FU | Azole | Notified | | |
| pencycuron | 66063-05-6 | | 402 | FU | Urea | Notified | | |
| prochloraz | 67747-09-5 | 266-994-5 | 407 | FU | Azole | Notified | | |
| procymidone | 32809-16-8 | | 383 | FU | Unclassified | pending | | |
| propamocarb | 24579-73-5 | | 399 | FU | Other Carbamate | Notified | | |
| propiconazol | 60207-90-1 | | 408 | FU | Azole | pending | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| pyrifenox | 88283-41-4 | | 448 | FU | Unclassified | Out 7/03 | | |
| pyrimethanil | 53112-28-0 | | 8270 | FU | Pyrimidine | Notified | | |
| quinoxyfen | 124495-18-7 | | | FU | Unclassified | new ai | | |
| sodium bicarbonate (nahco3) | 144-55-8 | | | FU | Inorganic | out | | |
| spiroxamine | 118134-30-8 | | | FU | Unclassified | Annex I, new ai | | |
| sulfur | 7704-34-9 | | 18 | FU | Inorganic | | | |
| tebuconazol | 107534-96-3 | | 494 | FU | Azole | Notified | | |
| tetraconazole | 112281-77-3 | 407-760-7 | 8323 | FU | Azole | Notified | | |
| thiabendazole | 148-79-8 | 205-725-8 | 323 | FU | Benzimidazole | Annex I | | |
| thiophanat-methyl | 23564-05-8 | 245-740-7 | 262 | FU | Benzimidazole | pending | | |
| thiram | 137-26-8 | 205-286-2 | 24 | FU | Dithiocarbamate | pending | | Yes* |
| triadimefon | 43121-43-3 | 256-103-8 | 352 | FU | Azole | Notified | | |
| triadimenol | 55219-65-3 | | 398 | FU | Azole | Notified | | |
| trichoderma harzianum rifai strain t-39 | 67892-31-3 | | | FU | Microbial | | | |
| trifloxystrobin | 141517-21-7 | | | FU | Strobin | new ai | | |
| triforine | 26644-46-2 | | 360 | FU | Unclassified | out 7/03 essential use | | |
| vinclozolin | 50471-44-8 | 256-599-6 | 280 | FU | Dicarboximide | pending | | |
| ziram | 137-30-4 | 205-288-3 | 31 | FU | Dithiocarbamate | pending | | |
| aluminium phosphide | 20859-73-8 | 244-088-0 | 227 | FUM | Inorganic | Notified | | |
| magnesiumphosphid | 12057-74-8 | 235-023-7 | 228 | FUM | Inorganic | Notified | | |
| dazomet | 533-74-4 | 208-576-7 | 146 | FUM, FU , NE, HB | Unclassified | Notified | | |
| 2,4-D | 94-75-7 | 202-361-1 | 1 | HB | Chlorophenoxy acid or ester | Annex I | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| acetochlor | 34256-82-1 | 251-899-3 | 496 | HB | Chloroacetanilide | Notified | | |
| acifluorfen | 50594-66-6 | 256-634-5 | 497 | HB | Diphenyl ether | out 7/03 essential use | | |
| alachlor | 15972-60-8 | 240-110-8 | 204 | HB | Chloroacetanilide | pending | P | |
| amidosulfuron | 120923-37-7 | | 515 | HB | Sulfonylurea | Notified | | |
| amitrol | 61-82-5 | 200-521-5 | 90 | HB | Unclassified | Annex I | | |
| asulam | 3337-71-1 | | 240 | HB | Other Carbamate | Notified | | |
| atrazine | 1912-24-9 | 217-617-8 | 91 | HB | Triazine | pending | PD | |
| bentazon | 25057-89-0 | 246-585-8 | 366 | HB | Unclassified | Annex I | | |
| bromoxynil | 1689-84-5 | 216-882-7 | 87 | HB | Hydroxybenzonitrile | pending | | |
| chloridazon | 1698-60-8 | 216-920-2 | 111 | HB | Pyridazinone | Notified | | |
| chlortoluron | 15545-48-9 | | 217 | HB | Urea | pending | | |
| cinidon-ethyl | 142891-20-1 | | | HB | Unclassified | new ai | | |
| clopyralid | 1702-17-6 | 216-935-4 | 455 | HB | Pyridinecarboxylic acid | Notified | | |
| cycloxydim | 101205-02-1 | | 510 | HB | Cyclohexenone derivative | Notified | | |
| desmedipham | 13684-56-5 | | 477 | HB | Bis-Carbamate | pending | | |
| dicamba | 1918-00-9 | 217-635-6 | 85 | HB | Benzoic acid | Notified | | |
| dichlobenil | 1194-65-6 | 214-787-5 | 73 | HB | Substituted Benzene | Notified | | |
| dichlorprop-p | 15165-67-0 | 403-980-1 | 476 | HB | Chlorophenoxy acid or ester | Notified | | |
| diflufenican | 83164-33-4 | | 462 | HB | Anilide | Notified | | |
| dimethenamid | 87674-68-8 | | 654 | HB | Amide | Notified | | |
| diquat dibromide | 85-00-7 | 201-579-4 | 55 | HB | Bipyridylium | Annex I | | |
| diuron | 330-54-1 | 206-354-4 | 100 | HB | Urea | Notified | PD | |
| ethofumesat | 26225-79-6 | 247-525-3 | 233 | HB | Unclassified | Annex I | | |
| fenoxaprop-p ethyl | 71283-80-2 | | 484 | HB | Aryloxyphenoxy propionic acid | Notified | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| fluazifop-p | 79241-46-6 | | 467 | HB | Aryloxyphenoxy propionic acid | Notified | | |
| flurochloridon | 61213-25-0 | | 430 | HB | Unclassified | Notified | | |
| fluroxypyr | 69377-81-7 | | 431 | HB | Unclassified | Annex I | | |
| glufosinate-ammonium | 77182-82-2 | 278-636-5 | 437 | HB | Unclassified | Notified | | |
| glyphosate | 1071-83-6 | 213-997-4 | 284 | HB | Phosphonoglycine | Annex I | | |
| glyphosate trimesium | 81591-81-3 | | | HB | Phosphonoglycine | Annex I | | |
| imazethapyr | 81335-77-5 | | 8184 | HB | Imidazolinone | Notified | | |
| ioxynil | 1689-83-4 | 216-881-1 | 86 | HB | Hydroxybenzonitrile | pending | | |
| isoproturon | 34123-59-6 | 251-835-4 | 336 | HB | Urea | Annex I | PD | |
| isoxaflutole | 141112-29-0 | | | HB | Unclassified | new ai, prov. until 18.4.2002 | | |
| linuron | 330-55-2 | 206-356-5 | 76 | HB | Urea | Annex I | | |
| MCPA | 94-74-6 | 202-360-6 | 2 | HB | Chlorophenoxy acid or ester | pending | | |
| mecoprop | 7085-19-0 | 202-264-4 | 51 | HB | Chlorophenoxy acid or ester | pending | | |
| mecoprop-p | 16484-77-8 | | 475 | HB | Chlorophenoxy acid or ester | pending | | |
| metamitron | 41394-05-2 | 255-349-3 | 381 | HB | Triazinone | Notified | | |
| metazachlor | 67129-08-2 | | 411 | HB | Chloroacetanilide | Notified | | |
| metolachlor | 51218-45-2 | | 400 | HB | Chloroacetanilide | Out 7/03 | | |
| metribuzin | 21087-64-9 | 244-209-7 | 283 | HB | Triazinone | Notified | | |
| napropamide | 15299-99-7 | | 271 | HB | Amide | Notified | | |
| nicosulfuron | 111991-09-4 | | 8228 | HB | Sulfonylurea | Notified | | |
| oxadiazon | 19666-30-9 | 243-215-7 | 213 | HB | Unclassified | Notified | | |
| oxyfluorfen | 42874-03-3 | | 538 | HB | Diphenyl ether | Notified | | |
| pendimethalin | 40487-42-1 | 254-938-2 | 357 | HB | 2,6-Dinitroaniline | Annex I | | |
| phenmedipham | 13684-63-4 | | 77 | HB | Bis-Carbamate | pending | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| primisulfuron-methyl | 86209-51-0 | | 8257 | HB | Sulfonylurea | Notified | | |
| prometryn | 7287-19-6 | | 93 | HB | Triazine | Notified | | |
| propanil | 709-98-8 | 211-914-6 | 205 | HB | Anilide | Notified | | |
| propaquizafop | 111479-05-1 | | 8260 | HB | Aryloxyphenoxy propionic acid | Notified | | |
| propyzamid | 23950-58-5 | 245-951-4 | 315 | HB | Amide | pending | | |
| prosulfuron | 94125-34-5 | | | HB | Sulfonylurea | new ai, prov. until 18.4.2002 | | |
| quizalofop-p-ethyl | 94051-08-8 | | 641 | HB | Aryloxyphenoxy propionic acid | Notified | | |
| rimsulfuron | 122931-48-0 | | 8278 | HB | Sulfonylurea | Notified | | |
| s-metolachlor | 87392-12-9 | | | HB | Chloroacetanilide | new ai | | |
| sethoxydim | 74051-80-2 | | 401 | HB | Cyclohexenone derivative | Out 7/03 | | |
| simazine | 122-34-9 | 204-535-2 | 22 | HB | Triazine | pending | PD | |
| terbuthylazin | 5915-41-3 | | 234 | HB | Triazine | Notified | | |
| thifensulfuron-methyl | 79277-27-3 | | | HB | Sulfonylurea | | | |
| triasulfuron | 82097-50-5 | | 480 | HB | Sulfonylurea | Annex I | | |
| tribenuron methyl | 101200-48-0 | 401-190-1 | 546 | HB | Sulfonylurea | Notified | | |
| trifluralin | 1582-09-8 | 216-428-8 | 183 | HB | 2,6-Dinitroaniline | Notified | PD | |
| triflusulfuron-methyl | 126535-15-7 | | 8347 | HB | Sulfonylurea | Notified | | |
| zinc sulphide | 7440-66-6 | 231-175-3 | | HB | Inorganic-Zinc | | | |
| hexythiazox (savey) | 78587-05-0 | | 439 | IGR, AC | Unclassified | Notified | | |
| acetamipirid | 135410-20-7 | | | IN | Chloro-nicotinyl | new ai | | |
| alpha-cypermethrin | 67375-30-8 | | 332 | IN | Pyrethroid | pending | | |
| azinphos methyl | 86-50-0 | 201-676-1 | 37 | IN | Organophosphorus | pending | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| bacillus thuringiensis, (berliner) | 68038-71-1 | | | IN | Microbial | | | |
| bensultap | 17606-31-4 | | 464 | IN | Unclassified | out 7/03 essentiial use | | |
| beta-cyfluthrin | 68359-37-5 | 269-855-7 | 385 | IN | Pyrethroid | Annex I | | |
| butoxycarboxim | 34681-23-7 | | 8040 | IN | N-Methyl Carbamate | Out 7/03 | | |
| calcium polysulfide | 1344-81-6 | 215-709-2 | 17 | IN | Inorganic | | | |
| calcium silicate | 10101-39-0 | | | IN | Inorganic | | | |
| carbaryl | 63-25-2 | 200-555-0 | 26 | IN | N-Methyl Carbamate | Notified | | |
| chlormephos | 24934-91-6 | 246-538-1 | 337 | IN | Organophosphorus | Out 7/03 | | |
| chlorpyrifos | 2921-88-2 | 220-864-4 | 221 | IN | Organophosphorus | pending | PD | |
| chlorpyrifos-methyl | 5598-13-0 | | 486 | IN | Organophosphorus | pending | | |
| cyromazine | 66215-27-8 | | 420 | IN | Triazine | Notified | | |
| deltamethrin | 52918-63-5 | 258-256-6 | 333 | IN | Pyrethroid | Annex I | | |
| demeton-s-methyl | 8022-00-2 | 213-052-6 | 47 | IN | Organophosphorus | Out 7/03 | | |
| diazinon | 333-41-5 | 206-373-8 | 15 | IN | Organophosphorus | Notified | | |
| dicofol | 115-32-2 | 204-082-0 | 123 | IN | Organochlorine | Notified | | |
| diflubenzuron | 35367-38-5 | | 339 | IN | Benzoylurea | Notified | | |
| dimethoat | 60-51-5 | 200-480-3 | 59 | IN | Organophosphorus | Notified | | |
| esfenvalerate | 66230-04-4 | | 481 | IN | Pyrethroid | Annex I | | |
| fenitrothion | 122-14-5 | 204-524-2 | 35 | IN | Organophosphorus | Notified | | |
| fenoxycarb | 72490-01-8 | 276-696-7 | 425 | IN | Other Carbamate | Notified | | |
| fenpyroximat | 134098-61-6 | | 8152 | IN | Unclassified | Notified | | |
| fenthion | 55-38-9 | 200-231-9 | 79 | IN | Organophosphorus | pending | | |
| heptenophos | 23560-59-0 | 245-737-0 | 527 | IN | Organophosphorus | Out 7/03 essential use | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| hexaflumuron | 86479-06-3 | | 8176 | IN | Benzoylurea | Notified | | |
| imidacloprid | 105827-78-9 | | 582 | IN | Chloro-nicotinyl | Notified | | |
| lufenuron | 103055-07-8 | 410-690-9 | 8203 | IN | Benzoylurea | Notified | | |
| methidathion | 950-37-8 | 213-449-4 | 193 | IN | Organophosphorus | Notified | | |
| methomyl | 16752-77-5 | 240-815-0 | 264 | IN | N-Methyl Carbamate | Notified | | |
| mineral oil | 8012-95-1 | | | IN | Petroleum derivative | | | |
| omethoate | 1113-02-6 | 214-197-8 | 202 | IN | Organophosphorus | Out 7/03 | | |
| phoxim | 14816-18-3 | 238-887-3 | 364 | IN | Organophosphorus | | | |
| pirimicarb | 23103-98-2 | 245-430-1 | 231 | IN | N-Methyl Carbamate | Notified | | |
| potassium silicate | 1312-76-1 | | | IN | Inorganic | | | |
| propoxur | 114-26-1 | 204-043-8 | 80 | IN | N-Methyl Carbamate | Out 7/03 | | |
| pymetrozine | 123312-89-0 | | | IN | Triazine | new ai | | |
| pyrethrine | 8003-34-7 | 232-319-8 | 32 | IN | Botanical | | | |
| pyridaphenthion | 119-12-0 | | 8269 | IN | Organophosphorus | Out 7/03 essential use | | |
| sodium metasilicate | 6834-92-0 | 229-912-9 | | IN | Inorganic | | | |
| sodium metasilicate, anhydrous | 6834-92-0 | 229-912-9 | | IN | Inorganic | | | |
| sodium silicate | 1344-09-8 | | | IN | Inorganic | | | |
| sulfotep | 3689-24-5 | 222-995-2 | 198 | IN | Organophosphorus | Out 7/03 | | |
| tebufenozid | 112410-23-8 | 412-850-3 | 8319 | IN | Diacylhydrazine | Notified | | |
| teflubenzuron | 83121-18-0 | | 450 | IN | Benzoylurea | Notified | | |
| thiametoxam | 153719-23-4 | | | IN | Unclassified | new ai, complete dossier sub. | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| thiocyclam hydrogen oxalate | 31895-22-4 | 250-859-2 | 542 | IN | Unclassified | Out 7/03 | | |
| trichlorfon | 52-68-6 | 200-149-3 | 68 | IN | Organophosphorus | Notified | | |
| triflumuron | 64628-44-0 | | 548 | IN | Benzoylurea | Notified | | |
| zeta-cypermethrin | 52315-07-8 | | | IN | Pyrethroid | Notified | | |
| carbofuran | 1563-66-2 | 216-353-0 | 276 | IN, NE | N-Methyl Carbamate | Notified | | Yes* |
| oxydemeton-methyl | 301-12-2 | 206-110-7 | 171 | IN, NE | Organophosphorus | Notified | | |
| iron phosphate | 10045-86-0 | | | MO | Inorganic | | | |
| metaldehyd | 9002-91-9 | | | MO | Pyrazolylphenyl | | | |
| alky-amin | | | | not spec. | Unclassified | | | |
| alkyl -phenol | | | | not spec. | Unclassified | | | |
| alkylaril polyglicoleter | nocas 319 | | | not spec. | Polyalkyloxy Compound | | | |
| co-polymers | | | | not spec. | Unclassified | | | |
| isobutylen | | | | not spec. | Unclassified | | | |
| jecoris oleum, cod liver oil | 8001-69-2 | | | not spec. | Animal derived | | | |
| octyl-phenol | | | | not spec. | Unclassified | | | |
| paraffin oils (petroleum) | 92129-09-4 | 295-810-6 | | not spec. | Unclassified | | | |
| parfum oil daphne | | | | not spec. | Unclassified | | | |
| rape oil | | | | not spec. | Unclassified | | | |
| silicates | | | | not spec. | Inorganic | | | |
| sodium hydrogen carbonate | | | | not spec. | Inorganic | | | |
| sodium salts oleum acids | 68443-05-0 | | | not spec. | Soap | | | |
| chlormequat chloride | 999-81-5 | 213-666-4 | 143 | PG | Quaternary Ammonium Compound | Notified | | |
| cholin chloride | 67-48-1 | | 8064 | PG | Unclassified | | | |

| Chemical Identification | | | | | | Regulatory Status | | |
|---|---|---|---|---|---|---|---|---|
| Substance | CAS Number | EC Number | CIPAC | Use Type | Chemical Class | Directive 91/414 | Water Directive | PIC |
| di-1-p-menthene | nocas 1381 | | 8110 | PG | Unclassified | Out 7/03 | | |
| ethephon | 16672-87-0 | 240-718-3 | 373 | PG | Organophosphorus | Notified | | |
| chlorpropham | 101-21-3 | | 43 | PG, HB | Other Carbamate | pending | | |
| dichlorprop | 120-36-5 | 204-390-5 | 84 | PG, HB | Chlorophenoxy acid or ester | Out 7/03 | | |
| brodifacoum | 56073-10-0 | 259-980-5 | 370 | RO | Coumarin | | | |
| bromadiolon | 28772-56-7 | | 371 | RO | Coumarin | | | |
| chlorphacinon | 3691-35-8 | 223-003-0 | 208 | RO | 1,3-Indandione | | | |
| difethialone | 104653-34-1 | | 549 | RO | Unclassified | | | |
| flocoumafen | 90035-08-8 | 421-960-0 | 453 | RO | Coumarin | | | |
| polyisobutylene | 9003-27-4 | | | RO | Polymer | | | |
| polyoxyethylene (15) coconut amine | 61781-14-8 | | | Soap/Surfactant | Polyalkyloxy Compound | | | |
| piperonylbutoxid | 51-03-6 | | 33 | Synergist | Unclassified | Not a PPP | | |

# Appendix 2 - Human Toxicology of Pesticides Authorized in Slovenia

Appendix 2 presents the human toxicity of the Pesticides Authorized in Slovenia according to several organisations. The classifications were taken from the from the World Health Organisation (WHO) and its Programme, from the European Union (Directive 67/548EEC), from the International Agency on Research of Cancer (IARC) and from the U.S. Environmental Protection Agency (U.S. EPA). Additional information was taken from scientific literature as noted in the footnotes of the describing chapters. To make this Appendix easier to read a list of abbreviations as well as a short repetition of the classifications will follow. Please note that the thorough description of the classification can be found in the single chapters. The source of the data can be found at the end of each classification.

## List of Abbreviations - Appendix 2

| | |
|---|---|
| CAS Number | Chemical Registry Abstract Number |
| WHO | World Health Organisation |
| EC | European Community |
| IARC | International Agency on Research of Cancer |
| U.S. EPA | U.S. Environmental Protection Agency |
| Prop 65 | California's *The Safe Drinking Water and Toxic Enforcement Act of 1986* (Proposition 65) |
| ChE | Cholinesterase Inhibition |
| ADI | Acceptable Daily Intake in mg/kg/bw |
| bw | Body Weight |
| Muta | Mutagenicity |
| Reprod. | Reprod. Toxicant |

## Acute Toxicity - World Health Organisation (WHO)

| Classification | |
|---|---|
| Ia | Extremely hazardous |
| Ib | Highly hazardous |
| II | Moderately hazardous |
| III | Slightly hazardous |
| U | Unlikely to present hazard in normal use |

**Source:** World Health Organisation (2000-02): The WHO Recommended Classification of Pesticides by Hazard And Guidelines to Classification 2000-02

## Classification of the EU

| Symbol | Description |
|---|---|
| T+ | Very toxic |
| T | Toxic |
| Xn | Harmful |
| Xi | Irritant |

Several entries into the toxicity category define different toxicities for different exposure routes, the risk phrases 24-26/28 for instance means R24: Toxic in contact with skin and R26/28 Very toxic by inhalation and if swallowed.
The next list shows all risk phrases according to Directive 67/548. The risk phrases in the Appendix table also include environmental hazards (R50 - R56, R59) which are described in Appendix 4.

**List of EC Risk Phrases to find in Appendix 2**

| Risk Phrase | Explanation |
|---|---|
| R 20 | Harmful by inhalation. |
| R 20/21 | Harmful by inhalation and in contact with skin. |
| R 20/21/22 | Harmful by inhalation, in contact with skin and if swallowed. |
| R 20/22 | Harmful by inhalation and if swallowed. |
| R 21 | Harmful in contact with skin. |
| R 21/22 | Harmful in contact with skin and if swallowed. |
| R 22 | Harmful if swallowed. |
| R 23 | Toxic by inhalation. |
| R 23/24 | Toxic by inhalation and in contact with skin. |
| R 23/24/25 | Toxic by inhalation, in contact with skin and if swallowed. |
| R 23/25 | Toxic by inhalation and if swallowed. |
| R 24 | Toxic in contact with skin. |
| R 24/25 | Toxic in contact with skin and if swallowed. |
| R 25 | Toxic if swallowed. |
| R 26 | Very toxic by inhalation. |
| R 26/27 | Very toxic by inhalation and in contact with skin. |
| R 26/27/28 | Very toxic by inhalation, in contact with skin and if swallowed. |
| R 26/28 | Very toxic by inhalation and if swallowed. |
| R 27 | Very toxic in contact with skin. |
| R 27/28 | Very toxic in contact with skin and if swallowed. |
| R 28 | Very toxic if swallowed. |
| R 29 | Contact with water liberates toxic gas. |
| R 30 | Can become highly flammable in use. |
| R 31 | Contact with acids liberates toxic gas. |
| R 32 | Contact with acids liberates very toxic gas. |

| Risk Phrase | Explanation |
|---|---|
| R 33 | Danger of cumulative effects. |
| R 34 | Causes burns. |
| R 35 | Causes severe burns. |
| R 36 | Irritating to eyes. |
| R 36/37 | Irritating to eyes and respiratory system. |
| R 36/37/38 | Irritating to eyes, respiratory system and skin. |
| R 36/38 | Irritating to eyes and skin. |
| R 37 | Irritating to respiratory system. |
| R 37/38 | Irritating to respiratory system and skin. |
| R 38 | Irritating to skin. |
| R 39 | Danger of very serious irreversible effects. |
| R 39/23 | Toxic: danger of very serious irreversible effects through inhalation. |
| R 39/23/24 | Toxic: danger of very serious irreversible effects through inhalation and in contact with skin. |
| R 39/23/24/25 | Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed. |
| R 39/23/25 | Toxic: danger of very serious irreversible effects through inhalation and if swallowed. |
| R 39/24 | Toxic: danger of very serious irreversible effects in contact with skin. |
| R 39/24/25 | Toxic: danger of very serious irreversible effects in contact with skin and if swallowed. |
| R 39/25 | Toxic: danger of very serious irreversible effects if swallowed. |
| R 39/26 | Very toxic: danger of very serious irreversible effects through inhalation. |
| R 39/26/27 | Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin. |
| R 39/26/27/28 | Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed. |
| R 39/26/28 | Very toxic: danger of very serious irreversible effects through inhalation and if swallowed. |
| R 39/27 | Very toxic: danger of very serious irreversible effects in contact with skin. |
| R 39/27/28 | Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed. |
| R 39/28 | Very toxic: danger of very serious irreversible effects if swallowed. |
| R 40 | Limited evidence of a carcinogenic effect. |
| R 41 | Risk of serious damage to eyes. |
| R 42 | May cause sensitization by inhalation. |
| R 42/43 | May cause sensitization by inhalation and skin contact. |
| R 43 | May cause sensitization by skin contact. |
| R 44 | Risk of explosion if heated under confinement. |
| R 45 | May cause cancer. |
| R 46 | May cause heritable genetic damage. |

| Risk Phrase | Explanation |
|---|---|
| R 48 | Danger of serious damage to health by prolonged exposure. |
| R 48/20 | Harmful: danger of serious damage to health by prolonged exposure through inhalation. |
| R 48/20/21 | Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin. |
| R 48/20/21/22 | Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. |
| R 48/20/22 | Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed. |
| R 48/21 | Harmful: danger of serious damage to health by prolonged exposure in contact with skin. |
| R 48/21/22 | Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed. |
| R 48/22 | Harmful: danger of serious damage to health by prolonged exposure if swallowed. |
| R 48/23 | Toxic: danger of serious damage to health by prolonged exposure through inhalation. |
| R 48/23/24 | Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin. |
| R 48/23/24/25 | Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. |
| R 48/23/25 | Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed. |
| R 48/24 | Toxic: danger of serious damage to health by prolonged exposure in contact with skin. |
| R 48/24/25 | Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed. |
| R 48/25 | Toxic: danger of serious damage to health by prolonged exposure if swallowed. |
| R 49 | May cause cancer by inhalation. |
| R 60 | May impair fertility. |
| R 61 | May cause harm to the unborn child. |
| R 62 | Possible risk of impaired fertility. |
| R 63 | Possible risk of harm to the unborn child. |
| R 64 | May cause harm to breast-fed babies. |
| R 65 | Harmful: may cause lung damage if swallowed. |
| R 66 | Repeated exposure may cause skin dryness or cracking. |
| R 67 | Vapours may cause drowsiness and dizziness. |
| R 68 | Possible risks of irreversible effects. |
| R 68/20 | Harmful: possible risk of irreversible effects through inhalation. |
| R 68/20/21 | Harmful: possible risk of irreversible effects through inhalation and in contact with skin. |

| Risk Phrase | Explanation |
|---|---|
| R 68/20/21/22 | Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed. |
| R 68/20/22 | Harmful: possible risk of irreversible effects through inhalation and if swallowed. |
| R 68/21 | Harmful: possible risk of irreversible effects in contact with skin. |
| R 68/21/22 | Harmful: possible risk of irreversible effects in contact with skin and if swallowed. |
| R 68/22 | Harmful: possible risk of irreversible effects if swallowed. |

**Source:** Commission Directive 2001/59/EC of 6 August 2001 adapting to technical progress for the 28th time Council Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances

**Cancer Classification of the EC**

| Category | Description |
|---|---|
| Category 1 | Substances known to be carcinogenic to humans. There is sufficient evidence to establish a causal association between human exposure to a substance and the development of cancer. |
| Category 2 | Substances which should be regarded as if they are carcinogenic to humans. There is sufficient evidence to provide a strong presumption that human exposure to a substance may result in the development of cancer, generally on the basis of appropriate long-term animal studies or other relevant information. |
| Category 3 | Substances which cause concern for humans owing to possible carcinogenic effects but in respect of which the available information is not adequate for making a satisfactory assessment. There is some evidence from appropriate animal studies, but this is insufficient to place the substance in Category 2. |

**Source:** European Community (1967): Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal 196, Brussels, Belgium, plus several amendments, adaptions and modifications as noted in the footnotes of the chapters

## Cancer Classification of the IARC

| Group | Description |
|---|---|
| Group 1 | The agent (mixture) is carcinogenic to humans. |
| Group 2A | The agent (mixture) is probably carcinogenic to humans. |
| Group 2B | The agent (mixture) is possibly carcinogenic to humans. |
| Group 3 | The agent (mixture or exposure circumstance) is not classifiable as to its carcinogenicity to humans. |
| Group 4 | The agent (mixture) is probably not carcinogenic to humans. |

**Source:** International Agency for Research on Cancer (1999): Preamble to the IARC Monographs, IARS Monographs, accessible through: http://www.iarc.fr/, Lyon, France

## Cancer Classification of the U.S. EPA 1986 to present

| Category 1986-1996 | Description |
|---|---|
| Category A | Known to cause cancer in humans. Generally based on epidemiological data showing sufficient evidence to support a causal association between exposure to the substance and cancer. |
| Category B | Known to cause cancer in animals but not yet definitively shown to cause cancer in humans. These chemicals are designated “probable human carcinogens.” Category B is further split into pesticides for which some evidence exists that it causes cancer in humans (B1) and those for which evidence exists only in animals (B2). |
| Category C | Possible human carcinogens, where the data show limited evidence of carcinogenicity in the absence of human data. |
| Category D | This category is for chemicals for which the data are either incomplete or ambiguous and is labelled “cannot be determined.” This category is appropriate when tumour effects or other key data are suggestive or conflicting or limited in quantity and are thus not adequate to convincingly demonstrate carcinogenic potential for humans. In general, further chemical-specific and generic research and testing are needed to be able to describe human carcinogenic potential. |
| Category E | Probably not carcinogenic, with no evidence of carcinogenicity in at least two adequate animal tests in different species in adequate epidemiological and animal studies. This classification is based on available evidence and does not mean that the agent will not be a carcinogen under any circumstances. |

| Category 1996-1999 | Description |
|---|---|
| Known/Likely | This category of descriptors is appropriate when the available tumor effects and other key data are adequate to convincingly demonstrate carcinogenic potential for humans, it includes:<br>Agents known to be carcinogenic in humans based on either epidemiologic evidence of a combination of epidemiologic and experimental evidence, demonstrating causality between human exposure and cancer. Agents that should be treated as if they were known human carcinogens, based on a combination of epidemiologic data showing a plausible causal association (not demonstrating it definitively) and strong experimental evidence. Agents that are likely to produce cancer in humans due to the production or anticipated production of tumors by modes of action that are relevant or assumed to be relevant to human carcinogenicity. |
| Cannot be determined | This category of descriptors is appropriate when available tumor effects or other key data are suggestive or conflicting or limited in quantity and thus, are not adequate to convincingly demonstrate carcinogenic potential for humans. In general, further agent-specific and generic research and testing are needed to be able to describe human carcinogenic potential. The descriptor 'cannot be determined' is used with a subdescriptor that further specifies the rationale:<br>Agents whose carcinogenic potential cannot be determined, but for which there is suggestive evidence that raises concern for carcinogenic effects. Agents whose carcinogenic potential cannot be determined because the existing evidence is composed of conflicting data (e.g., some evidence is suggestive of carcinogenic effects, but other equally pertinent evidence does not confirm any concern), agents whose carcinogenic potential cannot be determined because there are inadequate data to perform an assessment. Agents whose carcinogenic potential cannot be determined because no data arr available to perform an assessment. |
| Not likely | This is the appropriate descriptor when experimental evidence is satisfactory for deciding that there is no basis for human hazard concern, as follows (in the absence of human data suggesting a potential for cancer effects): Agents not likely to be carcinogenic to humans because they have been evaluated in at least two well conducted studies in two appropriate animal species without demonstrating carcinogenic effects. Agents not likely to be carcinogenic to humans because they have been appropriately evaluated in animals and show only carcinogenic effects that have been shown not to be relevant to humans (e.g., showing only effects in the male rat kidney due to accumulation of alpha(2u)-globulin). Agents not likely to be carcinogenic to humans when carcinogenicity is dose or route dependent. For instance, not likely below a certain dose range (categorized as likely by another route of exposure). To qualify, agents will have been appropriately evaluated in animal studies and the only effects show a dose range or route limitation, or a route limitation is otherwise shown by empirical data. Agents not likely to be carcinogenic to humans based on extensive human experience that demonstrates lack of effect (e.g., phenobarbital). |

| Category 1999 to present | Description |
|---|---|
| Carcinogenic to humans | This descriptor is appropriate when there is convincing epidemiologic evidence demonstrating causality between human exposure and cancer. This descriptor is also appropriate when there is an absence of conclusive epidemiologic evidence to clearly establish a cause and effect relationship between human exposure and cancer, but there is compelling evidence of carcinogenicity in animals and mechanistic information in animals and humans demonstrating similar mode(s) of carcinogenic action. It is used when all of the following conditions are met:<br>There is evidence in a human population(s) of association of exposure to the agent with cancer, but not enough to show a causal association, and There is extensive evidence of carcinogenicity, and<br>The mode(s) of carcinogenic action and associated key events have been identified in animals, and<br>The key events that precede the cancer response in animals have been observed in the human population(s) that also shows evidence of an association of exposure to the agent with cancer. |
| Likely to be carcinogenic to humans | This descriptor is appropriate when the available tumor effects and other key data are adequate to demonstrate carcinogenic potential to humans. Adequate data are within a spectrum. At one end is evidence for an association between human exposure to the agent and cancer and strong experimental evidence of carcinogenicity in animals; at the other, with no human data, the weight of experimental evidence shows animal carcinogenicity by a mode or modes of action that are relevant or assumed to be relevant to humans. |
| Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential | This descriptor is appropriate when the evidence from human or animal data is suggestive of carcinogenicity, which raises a concern for carcinogenic effects, but is judged not sufficient for a conclusion as to human carcinogenic potential. Examples of such evidence may include; a marginal increase in tumors that may be exposure-related, or evidence is observed only in a single study, or the only evidence is limited to certain high background tumors in one sex of one species. Dose-response assessment is not indicated for these agents. Further studies would be needed to determine human carcinogenic potential. |
| Data are inadequate for an assessment of human carcinogenic potential | This descriptor is used when available data are judged inadequate to perform an assessment. This includes a case when there is a lack of pertinent or useful data or when existing evidence is conflicting, e.g., some evidence is suggestive of carcinogenic effects, but other equally pertinent evidence does not confirm a concern. |
| Not likely to be carcinogenic to humans | This descriptor is used when the available data are considered robust for deciding that there is no basis for human hazard concern. The judgement may be based on: Extensive human experience that demonstrates lack of carcinogenic effect (e.g., phenobarbital). Animal evidence that demonstrates lack of carcinogenic effect in at least two well designed and well conducted studies in two appropriate animal species (in the absence of human data suggesting a potential for cancer effects). Extensive experimental evidence showing that the only carcinogenic effects observed in animals are not considered relevant to humans (e.g., showing only effects in the male rat kidney due to accumulation of alpha-2u-globulin).Evidence that carcinogenic effects are not likely by a particular route of exposure. Evidence that carcinogenic effects are not anticipated below a defined dose range. |

**Source:** US Environmental Protection Agency Office of Pesticide Programmes (2000): List of Chemicals Evaluated for Carcinogenic Potential, U.S. EPA Office of Pesticide Programmes, Washington, DC, USA

### Mutagenicity Classification of the EU

| Category | Description |
|---|---|
| Category 1 | Substances known to be mutagenic to humans.<br>There is sufficient evidence to establish a causal association between human exposure to a substance and heritable genetic damage. |
| Category 2 | Substances which should be regarded as if they are mutagenic to humans.<br>There is sufficient evidence to provide a strong presumption that human exposure to the substance may result in the development of heritable genetic damage, generally on the basis of appropriate animal studies, or other relevant information. |
| Category 3 | Substances which cause concern for humans owing to possible mutagenic effects.<br>There is evidence from appropriate mutagenicity studies, but this is insufficient to place the substance in Category 2. |

**Source:** European Community (1967): Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal 196, Brussels, Belgium, plus several amendments, adaptions and modifications as noted in the footnotes of the chapters.

### EU Classification of Substances Toxic to Reproduction

| Category | Description |
|---|---|
| Category 1 | 1. Substances known to impair fertility in humans.<br>2. Substances known to cause developmental toxicity in humans. |
| Category 2 | 1. Substances known to impair fertility in humans.<br>2. Substances known to cause developmental toxicity in humans. |
| Category 3 | 1. Substances which cause concern for human fertility.<br>2. Substances which cause concern for humans owing to possible developmental toxic effects. |

**Source:** European Community (1967): Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal 196, Brussels, Belgium, plus several amendments, adaptions and modifications as noted in the footnotes of the chapters

### Cholinesterase Inhibition

**Sources:** 1. U.S. EPA, Office of Pesticide Programmes (2000): Science Policy on The Use of Data on Cholinesterase Inhibition for Risk Assessments of Organophosphorous and Carbamate Pesticides, Office of Pesticide Programme, US Environmental Protection Agency, Washington, USA

2. U.S. EPA, Office of Pesticide Programmes (2000): Science Policy on The Use of Data on Cholinesterase Inhibition for Risk Assessments of Organophosphorous and Carbamate Pesticides, p. 16. Office of Pesticide Programme, US Environmental Protection Agency, Washington, USA

### Acceptable Daily Intake (WHO)

The values in Appendix 4 should be interpreted as follows: the smaller the value i.e. the amount a human can consume on a daily basis, the greater is the chronic toxicity of the pesticide. *Fipronil*, *oxydemeton-methyl* and c*hlorfenvinphos* are therefore the pesticides with the highest chronic toxicity in the list of evaluated pesticides.

**Source:** World Health Organisation/ International Programme on Chemical Safety (1999): Inventory of IPCS and Other WHO Pesticide Evaluation and Summary of Toxicological Evaluations Performed by the Joint Meeting On Pesticide Residues (JMPR) through 1999, WHO/ IPCS, Vienna, Switzerland

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| dinocap | 39300-45-3 | AC, FU | III | Xn | 22-38 | | | E | | | | 0,008 |
| propineb | 12071-83-9 | AC, FU | U | | | | | | | | | 0,007 |
| acrinathrin | 101007-06-1 | AC, IN | U | | | | | D | | | | |
| amitraz | 33089-61-1 | AC, IN | III | Xn | 22 | | | C | | | | 0,01 |
| bromopropylate | 18181-80-1 | AC, IN | U | | | | | | | | | 0,03 |
| clofentezine | 74115-24-5 | AC, IN | U | | | | | C | | | | 0,02 |
| cyhexatin | 13121-70-5 | AC, IN | III | Xn | 20/21/22-50/53 | | | Not likely to be carcino-genic to humans | | | | 0,007 |
| dichlorvos (DDVP) | 62-73-7 | AC, IN | Ib | T+ | 24/25-26-43-50 | | 2B | C | | | Yes | 0,004 |
| endosulfan | 115-29-7 | AC, IN | II | T | 24/25-36-50/53 | | | E | | | | 0,006 |
| fenazaquin | 120928-09-8 | AC, IN | II | T | 20-25-50/53 | | | | | | | |
| lambda-cyhalothrin | 91465-08-6 | AC, IN | II | T+ | 21-25-26-50/53 | | | | | | | |
| malathion | 121-75-5 | AC, IN | III | Xn | 22 | | 3 | D | | | Yes | 0,3 |
| parathion | 56-38-2 | AC, IN | Ia | T+ | 27/28-50/53 | | 3 | C | | | Yes | 0,004 |
| permethrin | 52645-53-1 | AC, IN | II | Xn | 22 | | 3 | C | | | | 0,05 |
| pirimiphos-methyl | 29232-93-7 | AC, IN | III | Xn | 22 | | | Can not be determined | | | Yes | 0,03 |
| propargite | 2312-35-8 | AC, IN | III | Xn | 22-36-50/53 | | | B2 | | | | 0,01 |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | ADI mg/kg/bw |
| tetradifon | 116-29-0 | AC, IN | U | | | | | | | | | |
| methiocarb | 2032-65-7 | AC, IN, MO | Ib | T | 25-50/53 | | | D | | | Yes | 0,02 |
| phosalone | 2310-17-0 | AC,IN | II | T | 21-25-50/53 | | | | | | Yes | 0,02 |
| copper sulfate | 7758-99-8 | BA | | | | | | | | | | |
| copper hydroxide | 20427-59-2 | BA, FU | III | | | | | | | | | |
| copper oxychloride | 1332-40-7 | BA, FU | III | | | | | | | | | |
| azoxystrobin | 131860-33-8 | FU | U | T | 23-50/53 | | | Not Likely | | | | |
| benalaxyl | 71626-11-4 | FU | U | | | | | | | | | 0,05 |
| benomyl | 17804-35-2 | FU | U | Xn | 68 | | | C | | 3 | | 0,1 |
| bitertanol | 55179-31-2 | FU | U | | | | | | | | | 0,01 |
| captan | 133-06-2 | FU | U | T | 23-40-41-43-50 | 3 | 3 | B2 | | | | 0,1 |
| carbendazim | 10605-21-7 | FU | U | Xn | 68 | | | C | | 3 | | 0,03 |
| carboxin | 5234-68-4 | FU | U | | | | | | | | | |
| copper sulfate (basic) | 1344-73-6 | FU | | | | | | | | | | |
| cymoxanil | 57966-95-7 | FU | III | Xn | 22-43-50/53 | | | Not Likely | | | | |
| cyprodinil | 121552-61-2 | FU | | | | | | | | | | |
| dichlofluanid | 1085-98-9 | FU | U | Xn | 20-36-43-50/53 | | | | | | | 0,3 |
| difenoconazole | 119446-68-3 | FU | III | | | | | C | | | | |
| dimethomorph | 110488-70-5 | FU | U | | 51/53 | | | | | | | |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| diniconazole | 83657-18-5 | FU | | | | | | | | | | |
| dithianon | 3347-22-6 | FU | III | Xn | 22-50/53 | | | | | | | 0,01 |
| dodine | 2439-10-3 | FU | III | Xn | 22-36/38-50/53 | | | | | | | |
| epoxiconazole | 106325-08-0 | FU | | T | 61-40-62-51/53 | 3 | | | 2; 3 | | | |
| famoxadone | 131807-57-3 | FU | U | | | | | | | | | |
| fenarimol | 60168-88-9 | FU | U | Xn | 51/53-62-63-64 | | | E | 3 | | | 0,01 |
| fenbuconazol | 114369-43-6 | FU | | | 50/53 | | | C | | | | 0,03 |
| fenhexamid | 126833-17-8 | FU | U | | | | | | | | | |
| fenpropimorph | 67564-91-4 | FU | U | Xn | 20-38-51/53 | | | | | | | |
| fentin acetate | 900-95-8 | FU | II | T+ | 24/25-26-37/38-40-41-48/23-50/53-63 | 3 | | | 3 | | | 0,0005 |
| fentin-hydroxid | 76-87-9 | FU | II | T+ | 24/25-26-37/38-40-41-48/23-50/53-63 | 3 | | B2 | 3 | | | 0,0005 |
| fludioxonil | 131341-86-1 | FU | | | | | | | | | | |
| fluquinconazol | 136426-54-5 | FU | | T | 21-23/25-38-48/25-50/53 | | | | | | | |
| flutriafol | 76674-21-0 | FU | III | | | | | | | | | |
| folpet | 133-07-3 | FU | U | Xn | 20-36-40-43-50 | 3 | | B2 | | | | 0,1 |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| fosetyl-Al | 39148-24-8 | FU | | | | | | Not amenable to classification | | | | |
| guazatine | 13516-27-3 | FU | II | | | | | | | | | 0,03 |
| hexaconazole | 79983-71-4 | FU | U | Xi | 43-51/53 | | | C | | | | 0,005 |
| iprodione | 36734-19-7 | FU | U | Xn | 40-50/53 | 3 | | Likely | | | | 0,06 |
| kresoxim-methyl | 143390-89-0 | FU | | Xn | 40-50/53 | 3 | | Likely to be carcinogenic to humans | | | | |
| mancozeb | 8018-01-7 | FU | U | Xi | 37-43 | | | B2 | | | | 0,03 |
| metalaxyl | 57837-19-1 | FU | III | | | | | E | | | | 0,03 |
| metalaxyl-M | 70630-17-0 | FU | | Xn | 22-41 | | | | | | | |
| metiram | 9006-42-2 | FU | U | | | | | | | | | 0,03 |
| myclobutanil | 88671-89-0 | FU | III | Xn | 22-36-51/53-63 | | | E | 3 | | | 0,03 |
| ofurace | 58810-48-3 | FU | U | | | | | | | | | |
| penconazol | 66246-88-6 | FU | U | | | | | | | | | 0,03 |
| pencycuron | 66063-05-6 | FU | U | | | | | | | | | |
| prochloraz | 67747-09-5 | FU | III | Xn | 22-50/53 | | | C | | | | 0,01 |
| procymidone | 32809-16-8 | FU | U | | | | | B2 | | | | 0,1 |
| propamocarb | 24579-73-5 | FU | U | | | | | | | | | 0,1 |
| propiconazol | 60207-90-1 | FU | II | | | | | C | | | | 0,04 |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| pyrifenox | 88283-41-4 | FU | III | | | | | | | | | |
| pyrimethanil | 53112-28-0 | FU | U | | | | | C | | | | |
| quinoxyfen | 124495-18-7 | FU | U | Xi | 43-50/53 | | | | | | | |
| sodium bicarbonate (nahco3) | 144-55-8 | FU | | | | | | | | | | |
| spiroxamine | 118134-30-8 | FU | II | Xn | 20/21/22-38-43-50/53 | | | | | | | |
| sulfur | 7704-34-9 | FU | U | | | | | | | | | |
| tebuconazol | 107534-96-3 | FU | III | | | | | C | | | | 0,03 |
| tetraconazole | 112281-77-3 | FU | II | Xn | 20/22-40-51/53 | 3 | | Likely to be carcinogenic to humans | | | | |
| thiabendazol | 148-79-8 | FU | U | | 50/53 | | | Likely to be carcinogenic to humans | | | | 0,1 |
| thiophanat-methyl | 23564-05-8 | FU | U | Xn | 20-43-50/53-68 | | | Likely to be carcinogenic to humans | | 3 | | 0,02 |
| thiram | 137-26-8 | FU | III | Xn | 20/22-36/37-68-43 | | 3 | | | 3 | | 0,01 |
| triadimefon | 43121-43-3 | FU | III | Xn | 22-51/53 | | | C | | | | 0,03 |
| triadimenol | 55219-65-3 | FU | III | | | | | C | | | | 0,05 |
| trifloxystrobin | 141517-21-7 | FU | | | | | | | | | | |
| triforine | 26644-46-2 | FU | U | | | | | | | | | |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | ADI mg/kg/bw |
| vinclozolin | 50471-44-8 | FU | U | T | 60-61-40-43-51/53 | 3 | | C | 2 | | | 0,01 |
| ziram | 137-30-4 | FU | III | Xn | 22-36/37/38-68 | | 3 | Likely to be carcinogenic to humans | | 3 | | 0,02 |
| dazomet | 533-74-4 | FU, FUM , NE, HB | III | Xn | 22-36-50/53 | | | D | | | | |
| aluminium phosphide | 20859-73-8 | FUM | | F; T+ | 15/29-28-32 | | | | | | | |
| magnesiumphosphid | 12057-74-8 | FUM | | T+ | 15/29-28-50 | | | | | | | |
| 2,4-D | 94-75-7 | HB | II | Xn | 22-37-41-43-52/53 | | 2B | D | | | | 0,3 |
| acetochlor | 34256-82-1 | HB | III | Xn | 20-37/38-43-50/53 | | | B2 | | | | |
| acifluorfen | 50594-66-6 | HB | III | Xn | 22-38-41-50/53 | | | | | | | |
| alachlor | 15972-60-8 | HB | III | Xn | 22-40-43-50/53 | 3 | | Likely (high doses) Not likely (low doses) | | | | |
| amidosulfuron | 120923-37-7 | HB | | | | | | | | | | |
| amitrol | 61-82-5 | HB | U | Xn | 40-48/22-51/53 | 3 | 2B | B2 | | | | 0,002 |
| asulam | 3337-71-1 | HB | U | | | | | C | | | | |
| atrazine | 1912-24-9 | HB | U | Xn | 43-48/22-50/53 | | 3 | C | | | | 0,0007 |
| bentazon | 25057-89-0 | HB | III | Xn | 22-36-43-52/53 | | | E | | | | 0,1 |
| bromoxynil | 1689-84-5 | HB | II | T | 25-63 | | | C | 3 | | | |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| chloridazon | 1698-60-8 | HB | U | Xi | 43-50/53 | | | | | | | |
| chlortoluron | 15545-48-9 | HB | U | | | | | | | | | 0,015 |
| cinidon-ethyl | 142891-20-1 | HB | | | | | | | | | | |
| clopyralid | 1702-17-6 | HB | | Xi | 41-51/53 | | | | | | | |
| cycloxydim | 101205-02-1 | HB | U | | | | | | | | | 0,07 |
| desmedipham | 13684-56-5 | HB | U | | | | | E | | | | |
| dicamba | 1918-00-9 | HB | III | Xn | 22-41-52/53 | | | D | | | | |
| dichlobenil | 1194-65-6 | HB | U | Xn | 21-51/53 | | | C | | | | |
| dichlorprop-P | 15165-67-0 | HB | | Xn | 22-38-41-43 | | 2B | | | | | |
| diflufenican | 83164-33-4 | HB | U | | 52/53 | | | | | | | |
| dimethenamid | 87674-68-8 | HB | | | | | | C | | | | |
| diquat dibromide | 85-00-7 | HB | | T+ | 22-26-36/37/38-43-48/25-50/53 | | | E | | | | |
| diuron | 330-54-1 | HB | U | Xn | 22-40-48/22-50/53 | 3 | | Known/Likely | | | | |
| ethofumesat | 26225-79-6 | HB | U | | 51/53 | | | D | | | | |
| fenoxaprop-P-ethyl | 71283-80-2 | HB | | | | | | | | | | |
| fluazifop-P | 79241-46-6? | HB | | Xn | 50/53-63 | | | | 3 | | | |
| flurochloridon | 61213-25-0 | HB | U | | | | | | | | | |
| fluroxypyr | 69377-81-7 | HB | U | | 52/53 | | | Not Likely | | | | |
| glufosinate-ammonium | 77182-82-2 | HB | | Xn | 22 | | | | | | | |

| Chemical | CAS Number | Use Type | WHO | EU Classification | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| glyphosat | 1071-83-6 | HB | U | Xi | 41-51/53 | | | E | | | | 0,3 |
| glyphosate trimesium | 81591-81-3 | HB | | Xn | 22-51/53 | | | E | | | | |
| imazethapyr | 81335-77-5 | HB | U | | | | | | | | | |
| ioxynil | 1689-83-4 | HB | II | T | 21-25-50/53-63 | | | | 3 | | | |
| isoproturon | 34123-59-6 | HB | III | Xn | 22-40-50/53 | 3 | | | | | | |
| isoxaflutole | 141112-29-0 | HB | | Xn | 50/53-63 | | | | 3 | | | |
| linuron | 330-55-2 | HB | U | Xn | 22-40-48/22-50/53 | 3 | | C | | | | |
| mcpa | 94-74-6 | HB | III | Xn | 22-38-41 | | 2B | | | | | |
| mecoprop | 7085-19-0 | HB | III | Xn | 22-38-41 | | 2B | | | | | |
| mecoprop-p | 16484-77-8 | HB | III | | | | 2B | | | | | |
| metamitron | 41394-05-2 | HB | III | Xn | 22-50/53 | | | | | | | |
| metazachlor | 67129-08-2 | HB | U | | | | | | | | | |
| metolachlor | 51218-45-2 | HB | III | | | | | C | | | | 0,0015 |
| metribuzin | 21087-64-9 | HB | II | Xn | 22-50/53 | | | D | | | | |
| napropamide | 15299-99-7 | HB | U | | | | | | | | | |
| nicosulfuron | 111991-09-4 | HB | U | | | | | E | | | | |
| oxadiazon | 19666-30-9 | HB | U | | 50/53 | | | C | | | | |
| oxyfluorfen | 42874-03-3 | HB | U | | | | | C | | | | |
| pendimethalin | 40487-42-1 | HB | III | Xi | 43-50/53 | | | C | | | | 0,005 |
| phenmedipham | 13684-63-4 | HB | U | | | | | D | | | | |

| Chemical | CAS Number | Use Type | WHO | EU Classification | | Cancer Classification | | | EU Muta | EU Repro | ChE | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Symbol | Risk Phrase | EU | IARC | U.S EPA | | | | |
| primisulfuron-methyl | 86209-51-0 | HB | | | | | | D | | | | |
| prometryn | 7287-19-6 | HB | U | | | | | E | | | | |
| propanil | 709-98-8 | HB | III | Xn | 22-50 | | | | | | | 0,05 |
| propaquizafop | 111479-05-1 | HB | U | | | | | | | | | |
| propyzamid | 23950-58-5 | HB | U | Xn | 40-50/53 | 3 | | B2 | | | | |
| prosulfuron | 94125-34-5 | HB | | Xn | 22-50/53 | | | D | | | | |
| quizalofop-P-ethyl | 94051-08-8 | HB | | | | | | | | | | |
| rimsulfuron | 122931-48-0 | HB | U | | | | | E | | | | |
| S-metolachlor | 87392-12-9 | HB | | | | | | | | | | |
| sethoxydim | 74051-80-2 | HB | III | | | | | | | | | |
| simazine | 122-34-9 | HB | U | Xn | 40-50/53 | 3 | 3 | C | | | | |
| terbuthylazin | 5915-41-3 | HB | U | | | | | D | | | | |
| thifensulfuron-methyl | 79277-27-3 | HB | U | | | | | | | | | |
| triasulfuron | 82097-50-5 | HB | U | | 50/53 | | | E | | | | |
| tribenuron methyl | 101200-48-0 | HB | | Xi | 43 | | | C | | | | |
| trifluralin | 1582-09-8 | HB | U | Xi | 36-43-50/53 | | 3 | C | | | | 0,048 |
| triflusulfuron-methyl | 126535-15-7 | HB | U | | | | | C | | | | |
| zinc sulphide | 7440-66-6 | HB | | F | 15-17 | | | D | | | | |
| chlorpropham | 101-21-3 | HB, PG | U | | | | 3 | E | | | | 0,03 |
| dichlorprop | 120-36-5 | HB, PG | III | Xn | 21/22-38-41 | | | | | | | |

| Chemical | CAS Number | Use Type | WHO | EU Classification | | Cancer Classification | | | EU Muta | EU Repro | ChE | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Symbol | Risk Phrase | EU | IARC | U.S EPA | | | | |
| hexythiazox (savey) | 78587-05-0 | IGR, AC | U | | 50/53 | | | C | | | | 0,03 |
| acetamipirid | 135410-20-7 | IN | | | | | | | | | | |
| alpha-cypermethrin | 67375-30-8 | IN | II | | | | | | | | | |
| azinphos methyl | 86-50-0 | IN | Ib | T+ | 24-26/28-43-50/53 | | | E | | | Yes | 0,005 |
| bensultap | 17606-31-4 | IN | III | Xn | 22-50/53 | | | | | | | |
| beta-cyfluthrin | 68359-37-5 | IN | II | T+ | 23-28-50/53 | | | | | | | 0,02 |
| butoxycarboxim | 34681-23-7 | IN | Ib | | | | | | | | Yes | |
| calcium polysulfide | 1344-81-6 | IN | | Xi | 31-36/37/38-50 | | | | | | | |
| calcium silicate | 10101-39-0 | IN | | | | | | | | | | |
| carbaryl | 63-25-2 | IN | II | Xn | 22-40-50 | 3 | 3 | C | | | Yes | 0,008 |
| chlormephos | 24934-91-6 | IN | Ia | T+ | 27/28 | | | | | | Yes | |
| chlorpyrifos | 2921-88-2 | IN | II | T | 24/25-50/53 | | | E | | | Yes | 0,01 |
| chlorpyrifos-methyl | 5598-13-0 | IN | U | | | | | | | | Yes | 0,01 |
| cyromazine | 66215-27-8 | IN | U | | | | | E | | | | 0,02 |
| deltamethrin | 52918-63-5 | IN | II | T | 23/25-50/53 | | 3 | | | | | 0,01 |
| demeton-s-methyl | 8022-00-2 | IN | | T | 24/25-51/53 | | | | | | Yes | 0,0003 |
| diazinon | 333-41-5 | IN | II | Xn | 22-50/53 | | | Not Likely | | | Yes | 0,002 |
| dicofol | 115-32-2 | IN | III | Xn | 21/22-38-43-50/53 | | 3 | C | | | | 0,002 |
| diflubenzuron | 35367-38-5 | IN | U | | | | | E | | | | 0,02 |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| dimethoat | 60-51-5 | IN | II | Xn | 21/22 | | | C | | | Yes | 0,002 |
| esfenvalerat | 66230-04-4 | IN | II | T | 23/25-43-50/53 | | | E | | | | |
| fenitrothion | 122-14-5 | IN | II | Xn | 22-50/53 | | | E | | | Yes | 0,005 |
| fenoxycarb | 72490-01-8 | IN | U | | 50/53 | | | B2 | | | | |
| fenpyroximat | 134098-61-6 | IN | | | | | | Not Likely | | | | 0,01 |
| fenthion | 55-38-9 | IN | II | T | 21/22-23-68-48/ 25-50/53 | | | E | | 3 | Yes | 0,007 |
| heptenophos | 23560-59-0 | IN | Ib | T | 25 | | | | | | | |
| hexaflumuron | 86479-06-3 | IN | U | | | | | | | | | |
| imidacloprid | 105827-78-9 | IN | | | | | | E | | | | |
| lufenuron | 103055-07-8 | IN | | Xi | 43-50/53 | | | | | | | |
| methidathion | 950-37-8 | IN | Ib | T+ | 21-28-50/53 | | | C | | | Yes | 0,001 |
| methomyl | 16752-77-5 | IN | Ib | T+ | 28-50/53 | | | Not Likely | | | Yes | 0,02 |
| mineral oil | 8012-95-1 | IN | | | | | 3 | | | | | |
| omethoate | 1113-02-6 | IN | Ib | T | 21-25-50 | | | | | | Yes | withdrawn |
| phoxim | 14816-18-3 | IN | II | Xn | 22 | | | | | | Yes | 0,004 |
| pirimicarb | 23103-98-2 | IN | II | T | 25-50/53 | | | | | | Yes | 0,02 |
| potassium silicate | 1312-76-1 | IN | | | | | | | | | | |
| propoxur | 114-26-1 | IN | II | T | 25-50/53 | | | B2 | | | Yes | 0,02 |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| pymetrozin | 123312-89-0 | IN | | | | | | Likely to be carcinogenic to humans | | | | |
| pyridaphenthion | 119-12-0 | IN | III | | | | | | | | | |
| sodium metasilicate | 6834-92-0 | IN | | C | 34-37 | | | | | | | |
| sodium metasilicate, anhydrous | 6834-92-0 | IN | | C | 34-37 | | | | | | | |
| sodium silicate | 1344-09-8 | IN | | | | | | | | | | |
| sulfotep | 3689-24-5 | IN | Ia | T+ | 27/28 | | | | | | | |
| tebufenozid | 112410-23-8 | IN | | | 51/53 | | | E | | | | |
| teflubenzuron | 83121-18-0 | IN | U | | | | | | | | | 0,01 |
| thiametoxam | 153719-23-4 | IN | | | | | | Likely to be carcinogenic to humans | | | | |
| thiocyclam hydrogen oxalate | 31895-22-4 | IN | II | Xn | 21/22-50/53 | | | | | | | |
| trichlorfon | 52-68-6 | IN | II | Xn | 22-43 | | 3 | Not likely to be carcino-genic at low doses, but likely to be carcinogenic at high doses | | | Yes | 0,02 |
| triflumuron | 64628-44-0 | IN | U | | | | | | | | | |

| Chemical | CAS Number | Use Type | EU Classification | | | Cancer Classification | | | | | | ADI mg/kg/bw |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WHO | Symbol | Risk Phrase | EU | IARC | U.S EPA | EU Muta | EU Repro | ChE | |
| zeta-cypermethrin | 52315-07-8 | IN | Ib - II | | | | | C | | | | 0,05 |
| carbofuran | 1563-66-2 | IN, NE | Ib | T+ | 26/28-50/53 | | | Not Likely | | | Yes | 0,01 |
| oxydemeton-methyl | 301-12-2 | IN, NE | Ib | T | 24/25-50 | | | Not Likely | | | Yes | 0,0003 |
| iron phosphate | 10045-86-0 | MO | | | | | | | | | | |
| metaldehyd | 9002-91-9 | MO | | | | | | | | | | |
| brodifacoum | 56073-10-0 | RO | Ia | T+ | 27/28-48/24/25-50/53 | | | | | | | |
| bromadiolon | 28772-56-7 | RO | Ia | | | | | | | | | |
| chlorphacinon | 3691-35-8 | RO | Ia | T+ | 23-27/28-48/24/25-50/53 | | | | | | | |
| difethialone | 104653-34-1 | RO | Ia | | | | | | | | | |
| flocoumafen | 90035-08-8 | RO | Ia | T+ | 26/27/28-48/23/24/25-50/53 | | | | | | | |
| polyisobutylene | 9003-27-4 | RO | | | | | | | | | | |
| jecoris oleum, cod liver oil | 8001-69-2 | | | | | | | | | | | |
| paraffin oils (petroleum), - unspecified | 92129-09-4 | | | T | 45 | | | | | | | |

# Appendix 3 - Ingredients Authorized in Slovenia and their Listing as Endocrine Disruptors

## EU Endocrine Disruption Categories

| Category | Description |
|---|---|
| Category 1 | At least one study providing evidence of endocrine disruption in an intact organism. Not a formal weight of evidence approach. |
| Category 2 | Potential for endocrine disruption. In vitro data indicating potential for endocrine disruption in intact organisms. Also includes effects in-vivo that may, or may not, be ED-mediated. May include structural analyses and metabolic considerations. |
| Category 3 | No scientific basis for inclusion in list.<br>Additionally category 3 distinguishes 3 subcategories:<br>A(w,m) - no data available on wildlife relevant and/or mammal relevant endocrine effects;<br>B - some data are available but the evidence is insufficient for identification.<br>C - data available indicating no scientific basis for inclusion in list |

## EU Persistence Categories

Highly persistent substances were selected on basis of Quantitative Structural Analysis Relationships (QSAR) derived from the Syracuse Estimation program. Combining two biodegradation models (the linear probability model and the ultimate degradation model), substances are considered as highly persistent that have a low probability of degradation (P<0.1) when applying the linear probability model and ultimately biodegrade in more than months when applying the ultimate degradation model. For the list only the highly persistent substances were selected with an ultimate degradation of more than months. This group was supplemented with a number of PCBs, polychlorinated -dioxins and -dibenzofurans, polybrominated -biphenyls and -biphenylethers, which were considered as very persistent by the expert group

Other substances added to the list were metals from the EDS working list.

In the list four categories are distinguished on persistence:

| Category | Criteria |
|---|---|
| Highly persistent substances (Pers+) | SRC calculations fulfilling the most stringent criteria |
| Persistent substances (Pers) | SRC calculations fulfilling less stringent criteria |
| Not persistent (Not pers) | SRC calculations not fulfilling criteria for persistence. |
| MetalSubstance is a metal | SRC calculations not used |
| No data | Biodegradation not calculated |

## EU Exposure Definition

In the list ED Category 1 substances are identified with high, medium or low exposure concern, applying the following criteria:

| Category | Criteria |
|---|---|
| High concern | Human exposure is expected, due to environmental concentrations and those in food or consumer products, also taking into consideration exposure of vulnerable groups *and*/*or* wildlife exposure is expected, due to use and emission patterns, and the chemical is persistent and bioaccumulative |
| Medium concern | Human exposure is not expected<br>*and* wildlife exposure is expected, due to use and emission patterns, but the chemical is readily biodegradable and not bioaccumulative |
| Low concern | No human exposure *and* no wildlife exposure |

| | | | | | | European Union | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chemical | Use Type | Colborn | Benbrook | EPA Illinois | Keith | EU Review. | EU ED Cat. | Persist. | Exposure Concern |
| amitraz | AC, IN | | | | | x | | Not pers | |
| dichlorvos, DDVP | AC, IN | | | | | x | | Not pers | |
| endosulfan | AC, IN | Estrogen | Y | K | Y | x | 2 | Pers+ | |
| lambda-cyhalothrin | AC, IN | Thyroid | | | | x | | Not pers | |
| malathion | AC, IN | Thyroid | | S | Y | x | 2 | Not pers | |
| permethrin | AD,IN, AC | Estrogenic | Y | S | | x | | Not pers | |
| copper oxychloride | BA, FU | | | | | x | 3 C | metal | |
| carbendazim | FU | | | | | x | 2 | Not pers | |
| difenoconazole | FU | | | | | x | | Pers | |
| fenarimol | FU | Estrogen | | | | x | | Pers | |
| fentin acetate | FU | | | | | x | 1 | metal | High |
| flutriafol | FU | | | | | x | | Pers | |
| iprodione | FU | Inhibition of testosterone synthesis | | | | x | 2 | Not pers | |
| mancozeb | FU | Thyroid | Y | P | Y | | | | |
| metiram | FU | | | P | Y | x | | Not pers | |

| Chemical | Use Type | Colborn | Benbrook | EPA Illinois | Keith | European Union: EU Review. | European Union: EU ED Cat. | European Union: Persist. | European Union: Exposure Concern |
|---|---|---|---|---|---|---|---|---|---|
| myclobutanil | FU | | | | | x | | Not pers | |
| prochloraz | FU | | | | | x | 2 | Not pers | |
| procymidone | FU | Androgen | | | | x | | Pers | |
| propiconazol | FU | | | | | x | | Pers | |
| tebuconazol | FU | | | | | x | | Not pers | |
| triadimefon | FU | Estrogen | | | | x | 2 | Not pers | |
| vinclozolin | FU | Androgen | Y | P | Y | x | 1 | Pers | High |
| ziram | FU | Thyroid | Y | S | Y | x | 2 | Not pers | |
| 2,4-D | HB | | Y | P | Y | x | 2 | Not pers | |
| acetochlor | HB | Thyroid (decrease of thyroid hormone levels, increase in TSH) | | | | x | 1 | Not pers | High |
| alachlor | HB | Thyroid (decrease of thyroid hormone levels, increase in TSH) | Y | P | Y | x | 1 | Not pers | High |
| amitrol | HB | Thyroid | | P | Y | x | 1 | Not pers | Medium |
| atrazine | HB | Neuroendocrine-pituitary (depression of LH surge), testosterone metabolism. | Y | K | Y | x | 1 | Pers | High |
| bromoxynil | HB | | | | | x | | Not pers | |
| diuron | HB | | | | | x | 2 | Not pers | |
| ioxynil | HB | | | | | x | | Not pers | |
| linuron | HB | Androgen | | | | x | 1 | Not pers | High |
| metribuzin | HB | Thyroid | Y | S | Y | x | | Not pers | |
| pendimethalin | HB | Thyroid | | | | x | | Pers | |
| prometryn | HB | | | | | x | | Not pers | |

| Chemical | Use Type | Colborn | Benbrook | EPA Illinois | Keith | European Union: EU Review. | European Union: EU ED Cat. | European Union: Persist. | European Union: Exposure Concern |
|---|---|---|---|---|---|---|---|---|---|
| propanil | HB | | | | | x | 2 | Not pers | |
| propyzamid | HB | | | | | x | | Not pers | |
| simazine | HB | | | | Y | x | 2 | Not pers | |
| trifluralin | HB | Reproductive/ Metabolic | Y | P | Y | x | | Pers | |
| carbaryl | IN | Estrogen and progesterone | Y | S | Y | x | | Not pers | |
| chlorpyrifos | IN | | Y | | Y | x | | Not pers | |
| deltamethrin | IN | | | | | x | | Not pers | |
| diazinon | IN | | | | | x | 2 | Not pers | |
| dicofol | IN | Estrogen | Y | K | Y | x | 2 | Pers | |
| diflubenzuron | IN | | | | | x | | Pers | |
| dimethoat | IN | | | | | x | 2 | Not pers | |
| esfenvalerat | IN | | | S | | x | | Not pers | |
| fenitrothion | IN | Antiandrogen | | | | x | | Not pers | |
| fenoxycarb | IN | | | | | x | | Not pers | |
| fenthion | IN | | | | | x | 3 C* | Not pers | |
| methomyl | IN | Thyroid | Y | S | Y | x | | Not pers | |
| omethoate | IN | | | | | x | | Not pers | |
| parathion | IN | | Y | P | Y | x | 2 | Not pers | |
| penconazol | IN | | | | | x | | Not pers | |
| piperonylbutoxid (synergist) | IN | | | | | x | | Not pers | |
| trichlorfon | IN | | | | | x | | Not pers | |
| zeta-cyper-methrin | IN | Disruption of reproductive function | Y | S | Y | x | | Not pers | |

| Chemical | Use Type | Colborn | Benbrook | EPA Illinois | Keith | European Union: EU Review. | European Union: EU ED Cat. | Persist. | Exposure Concern |
|---|---|---|---|---|---|---|---|---|---|
| carbofuran | IN, NE | | | | | x | | Not pers | |
| oxydemeton-methyl | IN, NE | | | | | x | | Not pers | |
| thiram | RE, FU | Neuroendocrine-pituitary (depression of LH surge), thyroid (decrease of T4, increase of TSH) | | | | x | 1 | Not pers | High |

Y = Yes; S = Suspected, K = Known, P = Probable

**Sources**:

European Commission (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, Delft

Illinois Environmental Protection Agency, (1997): Report on Endocrine Disrupting Chemicals, Illinois EPA, USA

L. H. Keith, (1997):Environmental Endocrine Disruptors: A Handbook of Property Data, Wiley Interscience, New York, USA

T. Colborn, D. Dumanoski, and J. P. Myers, (1996): Our Stolen Future, Penguin Books, New York, USA, accessible through http://www.osf-facts.org/

C. M. Benbrook, (1996): Growing Doubt: A Primer on Pesticides Identified as Endocrine Disruptors and/or Reproductive Toxicants, National Campaign for Pesticide Policy Reform

**Further Readings**

McLachlan, J.A., Arnold, S.F., (1996): Environmental Estrogens, American Scientist, accessible through http://www.amsci.org/amsci/articles/96articles/McLachla.html

Commission on Life Sciences, (2000): Hormonally Active Agents in the Environment, The National Academy of Science, Washington DC, USA, accessible through http://www.nap.edu/books/0309064198/html/

National Institute of Environmental Health Sciences (1997): Environmental Health Perspectives, Hormones and Health, USA, accessible http://ehpnet1.niehs.nih.gov/qa/105-5focus/focus.html

U.S. Environmental Protection Agency - Region 5 (1997): Proceedings Of The 1997 Great Lakes Endocrine Disrupters Symposium, U.S. EPA, Chicago, USA

**Web links**

The Global Endocrine Disruptor Research Inventory: http://endocrine.ei.jrc.it/gedri/pack_edri.All_Page

U.S. EPA, Office of Science Coordination and Policy: http://www.epa.gov/scipoly/oscpendo/resource.htm

Center for Bioenvironmental Research Tulane/Xavier Universities (CBR): http://www.som.tulane.edu/ecme/eehome/

Greater Boston Physicians for Social Responsibility: http://www.igc.org/psr/protect-child.htm

Environment Canada: http://www.ec.gc.ca/eds/fact/index.htm

# Appendix 4 - Environmental Toxicology of Pesticides Authorized in Slovenia

Appendix 4 presents the environmental toxicity of the pesticides authorized in Slovenia according to two organisations. The classifications were taken from the from the European Community (Directive 67/548EEC) and from the IPM (Integrated Pest Management) Programme of the University of Cornell.To make this Appendix easier to read a short repetition of the classifications will follow. Please note that the description of the classification can be found in the single chapters.

## Aquatic Toxicity - European Union

| | Acute Toxicity | | | |
|---|---|---|---|---|
| **Symbol** | **Fish $LC_{50}$, mg/L, 96h** | **Daphnia $LC_{50}$, mg/L, 96h** | **Algae $IC_{50}$, mg/L 72h** | **Risk Phrase** |
| N | 1 | 1 | 1 | R50 |
| N | 1 | 1 | 1 | R50/53 |
| N | 1 ≥ 10 | 1 ≥ 10 | 1 ≥ 10 | R51/53 |
| - | 10 ≥100 | 10 ≥100 | 10 ≥100 | R52/53 |
| - | - | - | - | R52 |

The Risk Phrases in the aboveTable mean the following:

R50: Very toxic to aquatic organisms
R51: Toxic to aquatic organisms
R52: Harmful to aquatic organisms
R53: May cause long-term adverse effects in the aquatic environment
R54: Toxic to flora.
R55: Toxic to fauna.
R56: Toxic to soil organisms.
R59: Dangerous for the ozone layer.

Combined Risk Phrases should be read with a 'comma' between the phrases, as in R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Source:** European Community (1993): Document 393L0021, Council Directive 93/21/EEC of 27 April 1993 adapting to technical progress for the 18th time Council Directive 67/548/EEC on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

## Ecological Impact - University of Cornell

**Source:** IPM Programme, Cornell University, New York State Agricultural Experiment Station Geneva (1999):A Method to Measure the Environmental Impact of Pesticides, accessible through http://www.nysaes.cornell.edu/ipmnet/ny/Programme_news/EIQ.html, New York, USA

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| dinocap | 39300-45-3 | AC, FU | | | 12 | 15 | 3 | 3 | 15,9 | 1 | 36,9 |
| propineb | 12071-83-9 | AC, FU | | | | | | | | | |
| acrinathrin | 101007-06-1 | AC, IN | | | | | | | | | |
| amitraz | 33089-61-1 | AC, IN | | | 6,5 | 3 | 9 | 3 | 18,2 | 3 | 33,2 |
| bromopropylate | 18181-80-1 | AC, IN | | | | | | | | | |
| clofentezine | 74115-24-5 | AC, IN | | | 4 | 16,1 | 9 | 9 | 52,8 | 1 | 86,9 |
| cyhexatin | 13121-70-5 | AC, IN | N | 50/53 | 6,2 | 3,2 | 18,8 | 5,7 | 27,2 | 2 | 55 |
| dichlorvos | 62-73-7 | AC, IN | N | 50 | 3 | 9,6 | 15 | 15 | 19,2 | 1 | 58,8 |
| endosulfan | 115-29-7 | AC, IN | N | 50/53 | 7 | 25 | 27 | 9 | 17,6 | 1 | 78,6 |
| fenazaquin | 120928-09-8 | AC, IN | N | 50/53 | | | | | | | |
| lambda-cyhalothrin | 91465-08-6 | AC, IN | N | 50/53 | 2,7 | 25 | 3 | 15 | 17,5 | 1 | 60,5 |
| malathion | 121-75-5 | AC, IN | | | 4,5 | 5 | 3 | 15 | 21 | 1 | 44 |
| parathion | 56-38-2 | AC, IN | N | 50/53 | 8 | 25 | 30 | 45 | 65,1 | 1 | 165,1 |
| permethrin | 52645-53-1 | AC, IN | | | 8,5 | 25 | 9 | 45 | 61,8 | 1 | 140,8 |
| pirimiphos-methyl | 29232-93-7 | AC, IN | | | | | | | | | |
| propargite | 2312-35-8 | AC, IN | N | 50/53 | 6 | 25 | 9 | 9 | 39,2 | 1 | 82,2 |
| tetradifon | 116-29-0 | AC, IN | | | | | | | | | |
| methiocarb | 2032-65-7 | AC, IN, MO | N | 50/53 | | | | | | | |
| phosalone | 2310-17-0 | AC,IN | N | 50/53 | 3,6 | 16,1 | 3 | 3 | 17,4 | 2 | 39,5 |
| copper sulfate | 7758-99-8 | BA | | | 14,5 | 25 | 9 | 3 | 10,9 | 1 | 47,9 |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| copper hydroxide | 20427-59-2 | BA, FU | | | 5,1 | 10,8 | 24,3 | 9,3 | 38,3 | 1 | 82,7 |
| copper oxychloride | 1332-40-7 | BA, FU | | | | | | | | | |
| azoxystrobin | 131860-33-8 | FU | N | 50/53 | 5 | 15 | 6 | 3 | 12,6 | 3 | 36,6 |
| benalaxyl | 71626-11-4 | FU | | | | | | | | | |
| benomyl | 17804-35-2 | FU | | | 50 | 25 | 15 | 15 | 73,5 | 5 | 128,5 |
| bitertanol | 55179-31-2 | FU | | | | | | | | | |
| captan | 133-06-2 | FU | N | 50 | 8 | 5 | 6 | 9 | 29,9 | 1 | 49,9 |
| carbendazim | 10605-21-7 | FU | | | | | | | | | |
| carboxin | 5234-68-4 | FU | | | 5,5 | 15 | 15 | 3 | 12,4 | 1 | 45,4 |
| copper sulfate (basic) | 1344-73-6 | FU | | | | | | | | | |
| cymoxanil | 57966-95-7 | FU | N | 50/53 | 5,5 | 3 | 3 | 3 | 12,4 | 3 | 21,4 |
| cyprodinil | 121552-61-2 | FU | | | | | | | | | |
| dichlofluanid | 1085-98-9 | FU | N | 50/53 | | | | | | | |
| difenoconazole | 119446-68-3 | FU | | | | | | | | | |
| dimethomorph | 110488-70-5 | FU | N | 51/53 | 10,1 | 3 | 9,1 | 9,1 | 37,5 | 1 | 58,7 |
| diniconazole | 83657-18-5 | FU | | | | | | | | | |
| dithianon | 3347-22-6 | FU | N | 50/53 | | | | | | | |
| dodine | 2439-10-3 | FU | N | 50/53 | 16,4 | 15 | 9,2 | 9,3 | 34,4 | 1 | 67,9 |
| epoxiconazole | 106325-08-0 | FU | N | 51/53 | | | | | | | |
| famoxadone | 131807-57-3 | FU | | | | | | | | | |
| fenarimol | 60168-88-9 | FU | N | 51/53 | 23 | 25 | 9 | 3 | 10 | 5 | 47 |
| fenbuconazol | 114369-43-6 | FU | N | 50/53 | | | | | | | |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| fenhexamid | 126833-17-8 | FU | | | | | | | | | |
| fenpropimorph | 67564-91-4 | FU | N | 51/53 | | | | | | | |
| fentin acetate | 900-95-8 | FU | N | 50/53 | | | | | | | |
| fentin-hydroxid | 76-87-9 | FU | N | 50/53 | 5 | 18 | 12 | 9 | 30 | 1 | 69 |
| fludioxonil | 131341-86-1 | FU | | | | | | | | | |
| fluquinconazol | 136426-54-5 | FU | N | 50/53 | | | | | | | |
| flutriafol | 76674-21-0 | FU | | | | | | | | | |
| folpet | 133-07-3 | FU | N | 50 | 5,7 | 10,8 | 12,2 | 9,3 | 20,6 | 1,6 | 52,9 |
| fosetyl-al | 39148-24-8 | FU | | | 7 | 1 | 3 | 3 | 15 | 1 | 22 |
| guazatine | 13516-27-3 | FU | | | | | | | | | |
| hexaconazole | 79983-71-4 | FU | N | 51/53 | | | | | | | |
| iprodione | 36734-19-7 | FU | N | 50/53 | 3,1 | 15 | 6,2 | 9,3 | 38,3 | 1 | 68,7 |
| kresoxim-methyl | 143390-89-0 | FU | N | 50/53 | | | | | | | |
| mancozeb | 8018-01-7 | FU | | | 17 | 25 | 12 | 15 | 78 | 1 | 130 |
| metalaxyl | 57837-19-1 | FU | | | 11 | 1 | 6 | 9 | 52,5 | 5 | 68,5 |
| metalaxyl-m | 70630-17-0 | FU | | | | | | | | | |
| metiram | 9006-42-2 | FU | | | 16 | 5 | 27 | 15 | 54,8 | 1 | 101,8 |
| myclobutanil | 88671-89-0 | FU | N | 51/53 | 13,8 | 13,7 | 12,2 | 9,3 | 38,3 | 1,6 | 73,4 |
| ofurace | 58810-48-3 | FU | | | | | | | | | |
| penconazol | 66246-88-6 | FU | | | | | | | | | |
| pencycuron | 66063-05-6 | FU | | | | | | | | | |
| prochloraz | 67747-09-5 | FU | N | 50/53 | | | | | | | |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| procymidone | 32809-16-8 | FU | | | | | | | | | |
| propamocarb | 24579-73-5 | FU | | | 3 | 3 | 3 | 3,3 | 25 | 1 | 34,3 |
| propiconazol | 60207-90-1 | FU | | | 14,6 | 3 | 9,1 | 9,1 | 30,6 | 1 | 51,7 |
| pyrifenox | 88283-41-4 | FU | | | | | | | | | |
| pyrimethanil | 53112-28-0 | FU | | | | | | | | | |
| quinoxyfen | 124495-18-7 | FU | N | 50/53 | | | | | | | |
| sodium bicarbonate (nahco3) | 144-55-8 | FU | | | | | | | | | |
| spiroxamine | 118134-30-8 | FU | N | 50/53 | | | | | | | |
| sulfur | 7704-34-9 | FU | | | 6 | 3,6 | 15 | 15 | 87 | 1 | 120,6 |
| tebuconazol | 107534-96-3 | FU | | | | | | | | | |
| tetraconazole | 112281-77-3 | FU | N | 51/53 | | | | | | | |
| thiabendazol | 148-79-8 | FU | N | 50/53 | | | | | | | |
| thiophanat-methyl | 23564-05-8 | FU | N | 50/53 | 28 | 9 | 9 | 15 | 63,5 | 1 | 96,5 |
| thiram | 137-26-8 | FU | | | 7,2 | 15 | 18,5 | 9,3 | 40,8 | 1 | 83,5 |
| triadimefon | 43121-43-3 | FU | N | 51/53 | 10 | 9 | 9 | 9 | 35 | 3 | 62 |
| triadimenol | 55219-65-3 | FU | | | | | | | | | |
| trifloxystrobin | 141517-21-7 | FU | | | | | | | | | |
| triforine | 26644-46-2 | FU | | | 25,9 | 13,7 | 12,2 | 9,3 | 38,3 | 1,6 | 73,4 |
| vinclozolin | 50471-44-8 | FU | N | 51/53 | 7,2 | 5 | 9,2 | 9,3 | 33,2 | 1 | 56,7 |
| ziram | 137-30-4 | FU | | | 13,2 | 3 | 24,3 | 9,3 | 31 | 1 | 67,6 |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| dazomet | 533-74-4 | FU, FUM , NE, HB | N | 50/53 | | | | | | | |
| aluminium phosphide | 20859-73-8 | FUM | | | | | | | | | |
| magnesiumphosphid | 12057-74-8 | FUM | N | 50 | | | | | | | |
| 2,4-D | 94-75-7 | HB | | 52/53 | 7 | 3 | 18 | 9 | 60 | 1 | 90 |
| acetochlor | 34256-82-1 | HB | N | 50/53 | | | | | | | |
| acifluorfen | 50594-66-6 | HB | N | 50/53 | 12 | 3 | 9 | 9 | 51 | 3 | 72 |
| alachlor | 15972-60-8 | HB | N | 50/53 | 6 | 9 | 3 | 3 | 25 | 3 | 40 |
| amidosulfuron | 120923-37-7 | HB | | | | | | | | | |
| amitrol | 61-82-5 | HB | N | 51/53 | 12 | 3 | 6 | 9 | 50,9 | 3 | 68,9 |
| asulam | 3337-71-1 | HB | | | | | | | | | |
| atrazine | 1912-24-9 | HB | N | 50/53 | 9,5 | 9 | 9 | 9 | 51 | 5 | 78 |
| bentazon | 25057-89-0 | HB | | 52/53 | 11 | 3 | 18 | 9 | 51 | 5 | 81 |
| bromoxynil | 1689-84-5 | HB | | | 4,8 | 15 | 17,1 | 3 | 17 | 1 | 52,1 |
| chloridazon | 1698-60-8 | HB | N | 50/53 | 7 | 3 | 9 | 3 | 20 | 5 | 35 |
| chlortoluron | 15545-48-9 | HB | | | | | | | | | |
| cinidon-ethyl | 142891-20-1 | HB | | | | | | | | | |
| clopyralid | 1702-17-6 | HB | N | 51/53 | | | | | | | |
| cycloxydim | 101205-02-1 | HB | | | | | | | | | |
| desmedipham | 13684-56-5 | HB | | | | | | | | | |
| dicamba | 1918-00-9 | HB | | 52/53 | 8 | 1 | 6 | 9 | 30 | 5 | 46 |
| dichlobenil | 1194-65-6 | HB | N | 51/53 | 7 | 3 | 6 | 3 | 17 | 5 | 29 |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| dichlorprop-p | 15165-67-0 | HB | | | | | | | | | |
| diflufenican | 83164-33-4 | HB | | 52/53 | | | | | | | |
| dimethenamid | 87674-68-8 | HB | | | 7,7 | 10,2 | 7,4 | 6,4 | 35,9 | 3 | 59,9 |
| diquat dibromide | 85-00-7 | HB | N | 50/53 | 7 | 5 | 27 | 3 | 17 | 1 | 52 |
| diuron | 330-54-1 | HB | N | 50/53 | 10,5 | 15 | 9 | 3 | 9 | 3 | 36 |
| ethofumesat | 26225-79-6 | HB | N | 51/53 | | | | | | | |
| fenoxaprop-p-ethyl | 71283-80-2 | HB | | | | | | | | | |
| fluazifop-p | 79241-46-6? | HB | N | 50/53 | | | | | | | |
| flurochloridon | 61213-25-0 | HB | | | | | | | | | |
| fluroxypyr | 69377-81-7 | HB | | 52/53 | | | | | | | |
| glufosinate-ammonium | 77182-82-2 | HB | | | 7,3 | 3 | 4,7 | 6,4 | 35,9 | 5 | 50 |
| glyphosat | 1071-83-6 | HB | N | 51/53 | 7 | 15 | 9 | 9 | 41,3 | 1 | 74,3 |
| glyphosate trimesium | 81591-81-3 | HB | N | 51/53 | | | | | | | |
| imazethapyr | 81335-77-5 | HB | | | 7 | 1 | 6 | 9 | 50,9 | 5 | 66,9 |
| ioxynil | 1689-83-4 | HB | N | 50/53 | | | | | | | |
| isoproturon | 34123-59-6 | HB | N | 50/53 | | | | | | | |
| isoxaflutole | 141112-29-0 | HB | N | 50/53 | | | | | | | |
| linuron | 330-55-2 | HB | N | 50/53 | 9 | 9 | 27 | 9 | 51 | 3 | 96 |
| mcpa | 94-74-6 | HB | | | | | | | | | |
| mecoprop | 7085-19-0 | HB | | | | | | | | | |
| mecoprop-p | 16484-77-8 | HB | | | 9,7 | 1 | 6 | 9 | 50,9 | 5 | 66,9 |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| metamitron | 41394-05-2 | HB | N | 50/53 | | | | | | | |
| metazachlor | 67129-08-2 | HB | | | | | | | | | |
| metolachlor | 51218-45-2 | HB | | | 7 | 9 | 6 | 3 | 17 | 3 | 35 |
| metribuzin | 21087-64-9 | HB | N | 50/53 | 8 | 3 | 27 | 9 | 51 | 5 | 90 |
| napropamide | 15299-99-7 | HB | | | 9,3 | 3 | 9 | 3 | 17 | 5 | 32 |
| nicosulfuron | 111991-09-4 | HB | | | 8 | 3,6 | 6 | 9 | 51 | 5 | 69,6 |
| oxadiazon | 19666-30-9 | HB | N | 50/53 | | | | | | | |
| oxyfluorfen | 42874-03-3 | HB | | | 8,5 | 25 | 27 | 9 | 51 | 1 | 112 |
| pendimethalin | 40487-42-1 | HB | N | 50/53 | 8,5 | 25 | 9 | 3 | 17 | 1 | 54 |
| phenmedipham | 13684-63-4 | HB | | | 5,5 | 10,5 | 13,5 | 9 | 40,1 | 1 | 73,1 |
| primisulfuron-methyl | 86209-51-0 | HB | | | | | | | | | |
| prometryn | 7287-19-6 | HB | | | | | | | | | |
| propanil | 709-98-8 | HB | N | 50 | 4 | 3 | 6 | 9 | 50,9 | 1 | 68,9 |
| propaquizafop | 111479-05-1 | HB | | | | | | | | | |
| propyzamid | 23950-58-5 | HB | N | 50/53 | 10 | 5 | 9 | 9 | 51 | 1 | 74 |
| prosulfuron | 94125-34-5 | HB | N | 50/53 | 8,7 | 1 | 7,4 | 6,4 | 35,9 | 5 | 50,7 |
| quizalofop-p-ethyl | 94051-08-8 | HB | | | | | | | | | |
| rimsulfuron | 122931-48-0 | HB | | | | | | | | | |
| s-metolachlor | 87392-12-9 | HB | | | | | | | | | |
| sethoxydim | 74051-80-2 | HB | | | 4,9 | 3,6 | 6 | 9 | 51 | 2,9 | 69,6 |
| simazine | 122-34-9 | HB | N | 50/53 | 9 | 3 | 6 | 3 | 14,2 | 5 | 26,2 |
| terbuthylazin | 5915-41-3 | HB | | | | | | | | | |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| thifensulfuron-methyl | 79277-27-3 | HB | | | 1,5 | 0 | 0 | 0 | 0 | 0 | 0 |
| triasulfuron | 82097-50-5 | HB | N | 50/53 | | | | | | | |
| tribenuron methyl | 101200-48-0 | HB | | | | | | | | | |
| trifluralin | 1582-09-8 | HB | N | 50/53 | 8,5 | 25 | 9 | 3 | 20 | 1 | 57 |
| triflusulfuron-methyl | 126535-15-7 | HB | | | | | | | | | |
| zinc sulphide | 7440-66-6 | HB | | | | | | | | | |
| chlorpropham | 101-21-3 | HB, PG | | | 5 | 15 | 6 | 3 | 17 | 1 | 41 |
| dichlorprop | 120-36-5 | HB, PG | | | 7,5 | 3 | 26,1 | 9 | 50,9 | 1 | 89 |
| hexythiazox (savey) | 78587-05-0 | IGR, AC | N | 50/53 | 6 | 25 | 9 | 9 | 52,8 | 1 | 95,8 |
| acetamipirid | 135410-20-7 | IN | | | | | | | | | |
| alpha-cypermethrin | 67375-30-8 | IN | | | | | | | | | |
| azinphos methyl | 86-50-0 | IN | N | 50/53 | 5 | 25 | 30 | 15 | 18,3 | 1 | 88,3 |
| bensultap | 17606-31-4 | IN | N | 50/53 | | | | | | | |
| beta-cyfluthrin | 68359-37-5 | IN | N | 50/53 | 7 | 5 | 9 | 45 | 60 | 1 | 119 |
| butoxycarboxim | 34681-23-7 | IN | | | | | | | | | |
| calcium polysulfide | 1344-81-6 | IN | N | 50 | | | | | | | |
| calcium silicate | 10101-39-0 | IN | | | | | | | | | |
| carbaryl | 63-25-2 | IN | N | 50 | 3 | 9 | 9 | 15 | 19,7 | 1 | 52,7 |
| chlormephos | 24934-91-6 | IN | | | | | | | | | |
| chlorpyrifos | 2921-88-2 | IN | N | 50/53 | 8,5 | 25 | 45 | 15 | 19,9 | 1 | 104,9 |
| chlorpyrifos-methyl | 5598-13-0 | IN | | | | | | | | | |
| cyromazine | 66215-27-8 | IN | | | 8,5 | 3 | 10,4 | 17,2 | 33,6 | 5 | 64,2 |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| deltamethrin | 52918-63-5 | IN | N | 50/53 | 3 | 16,1 | 3 | 15 | 20,4 | 2 | 54,5 |
| demeton-s-methyl | 8022-00-2 | IN | N | 51/53 | | | | | | | |
| diazinon | 333-41-5 | IN | N | 50/53 | 8 | 15 | 30 | 15 | 19,5 | 3 | 79,5 |
| dicofol | 115-32-2 | IN | N | 50/53 | 5 | 25 | 6 | 3 | 14,6 | 1 | 48,6 |
| diflubenzuron | 35367-38-5 | IN | | | 5,5 | 5 | 9 | 15 | 69 | 1 | 98 |
| dimethoat | 60-51-5 | IN | | | 9 | 5 | 30 | 45 | 60,9 | 3 | 140,9 |
| esfenvalerat | 66230-04-4 | IN | N | 50/53 | 4 | 25 | 9 | 45 | 57,8 | 1 | 136,8 |
| fenitrothion | 122-14-5 | IN | N | 50/53 | 5 | 3 | 15 | 15 | 20,5 | 3 | 53,5 |
| fenoxycarb | 72490-01-8 | IN | N | 50/53 | | | | | | | |
| fenpyroximat | 134098-61-6 | IN | | | | | | | | | |
| fenthion | 55-38-9 | IN | N | 50/53 | | | | | | | |
| heptenophos | 23560-59-0 | IN | | | | | | | | | |
| hexaflumuron | 86479-06-3 | IN | | | | | | | | | |
| imidacloprid | 105827-78-9 | IN | | | 19 | 1 | 12 | 45 | 22,5 | 1 | 80,5 |
| lufenuron | 103055-07-8 | IN | N | 50/53 | | | | | | | |
| methidathion | 950-37-8 | IN | N | 50/53 | 8 | 15 | 18 | 45 | 61,8 | 3 | 139,8 |
| methomyl | 16752-77-5 | IN | N | 50/53 | 11 | 15 | 30 | 15 | 21,5 | 5 | 81,5 |
| mineral oil | 8012-95-1 | IN | | | | | | | | | |
| omethoate | 1113-02-6 | IN | N | 50 | | | | | | | |
| phoxim | 14816-18-3 | IN | | | | | | | | | |
| pirimicarb | 23103-98-2 | IN | N | 50/53 | 11,4 | 3,2 | 24,8 | 3 | 15 | 2 | 45,9 |
| potassium silicate | 1312-76-1 | IN | | | | | | | | | |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| propoxur | 114-26-1 | IN | N | 50/53 | 13 | 16 | 60 | 45 | 55,8 | 1 | 176,8 |
| pymetrozin | 123312-89-0 | IN | | | | | | | | | |
| pyridaphenthion | 119-12-0 | IN | | | | | | | | | |
| sodium metasilicate | 6834-92-0 | IN | | | | | | | | | |
| sodium metasilicate, anhydrous | 6834-92-0 | IN | | | | | | | | | |
| sodium silicate | 1344-09-8 | IN | | | | | | | | | |
| sulfotep | 3689-24-5 | IN | | | | | | | | | |
| tebufenozid | 112410-23-8 | IN | N | 51/53 | 14 | 9 | 11 | 15 | 88 | 3 | 123 |
| teflubenzuron | 83121-18-0 | IN | | | | | | | | | |
| thiametoxam | 153719-23-4 | IN | | | | | | | | | |
| thiocyclam hydrogen oxalate | 31895-22-4 | IN | N | 50/53 | | | | | | | |
| trichlorfon | 52-68-6 | IN | | | 6,5 | 16,1 | 15 | 9 | 20,2 | 2 | 60,3 |
| triflumuron | 64628-44-0 | IN | | | | | | | | | |
| zeta-cypermethrin | 52315-07-8 | IN | | | | | | | | | |
| carbofuran | 1563-66-2 | IN, NE | N | 50/53 | 29 | 5 | 30 | 15 | 19,4 | 5 | 69,4 |
| oxydemeton-methyl | 301-12-2 | IN, NE | N | 50 | 29 | 5 | 30 | 27 | 60,6 | 5 | 122,6 |
| iron phosphate | 10045-86-0 | MO | | | | | | | | | |
| metaldehyd | 9002-91-9 | MO | | | | | | | | | |
| brodifacoum | 56073-10-0 | RO | N | 50/53 | | | | | | | |
| bromadiolon | 28772-56-7 | RO | | | | | | | | | |

| Pesticide | CAS Number | Use Type | European Union[a] | | Evaluation Cornell University (New York) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Risk Phrases | Fish | Birds | Bees | Beneficial Organism | Groundwater and Runoff Potential | Terrestrial Organisms | Ecological Impact |
| chlorphacinon | 3691-35-8 | RO | N | 50/53 | | | | | | | |
| difethialone | 104653-34-1 | RO | | | | | | | | | |
| flocoumafen | 90035-08-8 | RO | N | 50/53 | | | | | | | |
| polyisobutylene | 9003-27-4 | RO | | | | | | | | | |
| jecoris oleum, cod liver oil | 8001-69-2 | not spec. | | | | | | | | | |
| paraffin oils (petroleum), - unspecified | 92129-09-4 | not spec. | | | | | | | | | |

a. all pesticides with entries in Annex 1 of Council Directive 67/548 are listed in this table. Please note that Symbols and Risk Phrases for health hazards were removed.

# Appendix 5 - Pesticide Residues in German Food and Water

| Pesticide | CAS Number | Ground Water | Surface Water | Food/ Crop | Nr. |
|---|---|---|---|---|---|
| 2,4-D | 94-75-7 | x | x | | |
| alachlor | 15972-60-8 | x | | | |
| amitrol | 61-82-5 | x | x | | |
| atrazine | 1912-24-9 | x | x | carrots, | 1 |
| azinphos methyl | 86-50-0 | x | x | apple, | 1 |
| azoxystrobin | 131860-33-8 | | | wheat, | 1 |
| bentazon | 25057-89-0 | x | x | | |
| beta-cyfluthrin | 68359-37-5 | x | | zucchini, | 1 |
| bromopropylate | 18181-80-1 | | | apple, cherries canned, | 2 |
| bromoxynil | 1689-84-5 | x | x | | |
| captan | 133-06-2 | | | apple, pear, cherries canned, strawberries, table wine, cauliflower, Chinese cabbage, lettuce | 8 |
| carbaryl | 63-25-2 | | | apple, | 1 |
| carbendazim | 10605-21-7 | | | apple, strawberries, cauliflower, celery root, cucumber, lettuce, linnen seed, frozen peas, potatoes, savoy, | 10 |
| carbofuran | 1563-66-2 | x | x | strawberries, | 1 |
| chloridazon | 1698-60-8 | x | x | | |
| chlorpropham | 101-21-3 | | | potatoes, | 1 |
| chlorpyrifos | 2921-88-2 | | | apple, pear, cherries canned, table wine, cauliflower, carrots, celery root, zucchini, | 8 |
| chlorpyrifos-methyl | 5598-13-0 | x | | oats, strawberries, Chinese cabbage, | 3 |
| chlortoluron | 15545-48-9 | x | x | | |
| deltamethrin | 52918-63-5 | x | | wheat, apple, table wine, frozen spinach, | 4 |
| demeton-s-methyl | 8022-00-2 | x | | cherries canned, cauliflower, zucchini, | 3 |
| diazinon | 333-41-5 | x | x | wheat, rye, cauliflower, | 3 |
| dicamba | 1918-00-9 | x | | | |
| dichlobenil | 1194-65-6 | x | | | |
| dichlofluanid | 1085-98-9 | x | | wheat, rye, apple, pear, strawberries, table wine, cauliflower, carrots, celery root, Chinese cabbage, cucumber, onion, potatoes, | 13 |
| dichlorprop-p | 15165-67-0 | x | x | | |
| dichlorvos, DDVP | 62-73-7 | x | | wheat, carrots, potatoes, savoy, sunflower seed, | 5 |
| diflubenzuron | 35367-38-5 | x | | | |

| Pesticide | CAS Number | Ground Water | Surface Water | Food/ Crop | Nr. |
|---|---|---|---|---|---|
| dimethoat | 60-51-5 | x | x | wheat, rye, apple, cherries canned, asparagus, cauliflower, carrots, celery root, Chinese cabbage, cucumber, linnen seed, potatoes, savoy, frozen spinach, | 14 |
| diuron | 330-54-1 | x | x | | |
| endosulfan | 115-29-7 | x | x | apple, cherries canned, strawberries, broccoli, carrots, Chinese cabbage, linnen seed, onion, frozen peas, frozen spinach, zucchini, | 11 |
| ethephon | 16672-87-0 | x | | | |
| ethofumesat | 26225-79-6 | x | | | |
| fenitrothion | 122-14-5 | | x | | |
| fenpropimorph | 67564-91-4 | | | rye, celery root, savoy, | 3 |
| fenthion | 55-38-9 | x | | sweet cherries | 1 |
| flurochloridon | 61213-25-0 | x | | | |
| fluroxypyr | 69377-81-7 | x | | | |
| folpet | 133-07-3 | | | cherries canned, broccoli, cauliflower, Chinese cabbage, | 4 |
| glyphosat | 1071-83-6 | | x | | |
| ioxynil | 1689-83-4 | x | x | | |
| iprodione | 36734-19-7 | | | wheat, cherries canned, strawberries, carrots, Chinese cabbage, cucumber, lettuce, linnen seed, frozen peas, potatoes, savoy, frozen spinach, | 12 |
| isoproturon | 34123-59-6 | x | x | | |
| lambda-cyhalothrin | 91465-08-6 | x | | cherries canned, frozen spinach, | 2 |
| linuron | 330-55-2 | x | x | | |
| malathion | 121-75-5 | | | wheat, rye, oats, apple, linnen seed, | 5 |
| mcpa | 94-74-6 | x | x | | |
| mecoprop | 7085-19-0 | | x | | |
| metalaxyl | 57837-19-1 | x | x | wheat, broccoli, Chinese cabbage, lettuce, potatoes, | 5 |
| metamitron | 41394-05-2 | x | x | | |
| metazachlor | 67129-08-2 | x | x | | |
| methidathion | 950-37-8 | x | | | |
| metolachlor | 51218-45-2 | x | x | | |
| metribuzin | 21087-64-9 | x | x | | |
| myclobutanil | 88671-89-0 | | | strawberries, cucumber, | 2 |
| napropamide | 15299-99-7 | | x | | |
| omethoate | 1113-02-6 | | | cherries canned, savoy, frozen spinach, | 3 |
| oxydemeton-methyl | 301-12-2 | | | cauliflower, zucchini, | 2 |

| Pesticide | CAS Number | Ground Water | Surface Water | Food/ Crop | Nr. |
|---|---|---|---|---|---|
| parathion | 56-38-2 | x | x | apple, carrots, celery root, Chinese cabbage, savoy, frozen spinach, | 6 |
| penconazol | 66246-88-6 | | x | cucumber, | 1 |
| pendimethalin | 40487-42-1 | x | x | | |
| permethrin | 52645-53-1 | x | | broccoli, kale, mushroom cultivated (Agaricus), savoy, frozen spinach, | 7 |
| phosalone | 2310-17-0 | | | apple, plum, cherries canned, | 3 |
| pirimicarb | 23103-98-2 | x | | apple, broccoli, Chinese cabbage, lettuce, linnen seed, frozen peas, zucchini, | 7 |
| pirimiphos-methyl | 29232-93-7 | x | | wheat, rye, oats, linnen seed, | 4 |
| procymidone | 32809-16-8 | | | apple, cherries canned, strawberries, table wine, asparagus, broccoli, carrots, Chinese cabbage, cucumber, linnen seed, frozen peas, zucchini, | 12 |
| prometryn | 7287-19-6 | x | x | | |
| propoxur | 114-26-1 | | | cucumber, | 1 |
| propyzamid | 23950-58-5 | x | | strawberries, Chinese cabbage, potatoes, savoy, zucchini, | 5 |
| simazine | 122-34-9 | x | x | | |
| tebuconazol | 107534-96-3 | | x | | |
| terbuthylazin | 5915-41-3 | x | x | | |
| thiabendazol | 148-79-8 | | | wheat, pear, strawberries, asparagus, carrots, cucumber, kale, potatoes, savoy, | 9 |
| triadimefon | 43121-43-3 | | | celery root, savoy, frozen spinach, | 3 |
| triadimenol | 55219-65-3 | x | | rye, strawberries, | 2 |
| trifluralin | 1582-09-8 | | x | Chinese cabbage, linnen seed, frozen peas, | 3 |
| vinclozolin | 50471-44-8 | x | | wheat, cherries canned, strawberries, table wine, broccoli, cauliflower, carrots, Chinese cabbage, kale, lettuce, linnen seed, mushroom cultivated (Agaricus), onion, frozen peas, savoy, frozen spinach, zucchini, | 19 |
| zeta-cypermethrin | 52315-07-8 | x | | cherries canned, broccoli, celery root, Chinese cabbage, lettuce, savoy, zucchini, | 7 |

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# Appendix 6 - List of laws related to plant protection products issues in Slovenia

Law on Water (U.l. 38/81 and 52/00 and 67/02)
Land Use Planning Act (U.l. 18/84)
Environmental Protection Act (U.l. 32/93)
Farmland Act (U.l. 59/96)
Mineral Fertilizers Act (U.l. 24/73, 29/86)
Act on Plant Protection Products (U.l. 11/01)
Code of good agricultural practice in plant protection (Ministry of Agriculture, 2000)
Decree on more detailed measures on good agricultural practice (U.l. 81/2002)
Decree on input of harmful substances and plant nutrients into the soil (U.l. 68/96)
Decree on the limit, warning and critical concentration values of the dangerous substances in soil (U.l. 68/96)
Regulation on the operation monitoring of the input of dangerous substances and plant nutrients into the soil (U.l. 55/97)
Act of plant health protection