PAN Germany

Pesticides in Central and Eastern European Countries

Usage, Registration, Identification and Evaluation

Part 1: Poland

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.

PAN Germany
Nernstweg 32
22765 Hamburg, Germany
phone: +49-40-399 19 10-0
fax: +49-40-390 75 20
E-mail: info@pan-germany.org
website: www.pan-germany.org
Principal Authors:
Lars Neumeister (PAN Germany) & Ewa Hajduk (Polish Ecological Club City of Gliwice) (Chapter 3 - 7)

Editors: Susanne Smolka & Lars Neumeister

Proofreading: Olliver Heyen
ISBN: 3-9808321-3-9

Funds to this project were made available by the Ruben and Elisabeth Rausing Trust (United Kingdom). This support is gratefully acknowledged.

Table of Contents

List of Tables

List of Figures

1 Introduction

Pesticide use in EU accession countries has been very low for over a decade, but it is on the rise again. The accession of Poland 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 Poland.

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 pesticide use in Poland
- to characterise the pesticides active ingredients authorized in Poland 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,
- to determine their potential as water and food contaminants, and
- to list regulations addressing pesticides.

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 Agriculture

Polish agriculture differs from the one in European Union- and post communist -countries. Due to numerous historical circumstances it is also diversified from the West to the East and from the South to the North of Poland. There are properous regions with fertile soils and a high level of intensive agricultural production. Those regions will be able to compete against EU markets. However there are also regions where the soil quality is poor, basic and climatic conditions are adverse for farming and where farmers run small-scale farms.

Arable lands account for 59% (18,4 million ha) of the total area of the country with a rate of 0.48 ha of arable lands per capita. This numbers show the importance of farming from an economical and social point of view.

38% of the Polish population live in rural areas of which 19% work directly in the agriculture sector. Furthermore 43% of all unemployed people live in rural areas. At the same time the education level is very low, only 1,3% of the rural-inhabitants have got a university degree.

Agriculture plays still an important role in the Polish economy. However since the last decade a decreasing share of farming in the GDP has been observed (in 1988 – 11,8% of GDP, in 1994 - 6,4% of GDP and 2001 only 3,3%).

Compared to agriculture systems in other european countries, polish agriculture seems to be a lot closer to environmental solutions and improvements.. Efforts by the communist regime, to collectivise the agricultural sector weren‘ t very successful. Almost 50 years of communist efforts to collectivise this sector of economy did not bring any spectacular success. Most farmland is still in private hands, farms are small, multifunctional and land management is extensive. 92,2% of the land belongs to private owners and 7,8% is owned by the government.

The last decade brought great economic changes that effected Polish farmers more than any other social group. Nowadays Polish agriculture is extensive and sustainable in environmental sense more by the default than by farmers will. The crop yield of extensive farming is relatively low, due to low usage of pesticides and fertilizers. Vast areas of arable farmland in Poland could be therefore easily converted into organic agriculture. On the other hand, there is a tendency to intensify the agriculture production, linking up with structural changes and an increase pesticide use.

To equal the position of polish farmers in comparison to the position of farmers from EU member states, was the most important goal during the negoitation process. As a result 15% of money reserved for the development of rural areas was moved on to direct payments. Unfortunately the support for the organic farming didn‘t have priority for the Polish decision-makers.

3. 1 Polish Agriculture in Numbers

The number of people employed in the agricultural economy, hunting and forestry is totally 2.742 thousand people (18,9%), referring to the overall employment in 2000. On the other side, the percentage of unemployed people living in rural areas was 43,7% in 2000. In the same time the average percentage of unemployed people in Poland was 15% (all data in this paragraph are taken from the Ministry of Agriculture and Rural Development).

Agricultural products and processed food play an important role in Polish external trade. In 2000 the agri-food products accounted for 8,4% of total exports and for 6,5% of total imports. The main products, exported by Poland, are powder milk, chocolate, apple juice, meat, frozen

strawberries and sugar. The main products, imported by Poland are: lemons, oranges, tea, tomatoes and soya cake.

About 59% of the total polish area is arable land. Grassland and pastures account for 22,0%, orchards for 1,5% and the rest is wasteland. The protected areas in Poland account for about 31%. The amount of wasteland increases every year, because the quality of Polish soils is low. First and second class of soil is only 3% of all agriculture land.

Cereals and potatoes are the most cultivated plants in Poland. Cereals with corn are about 70,3% of the total area. The crop yields of cereals are quite low: about 28,3 dt/ha. Poland is the second biggest producer of potatoes in Europe with crop yields of 194 dt/ha in 2000, which accounts about for 10.1% of the total plant production in Poland. Some of the potatoes are processed into potato starch, but they are mainly used for human consumption and livestock feeding. Rapeseed and sugar beets are the other two important crops in Poland. Vegetable-production accounts for 2% of the total production and it takes up 250 100 ha. The main products are: cabbage, cauliflowers, onions, carrots, red beets, cucumbers and tomatoes.

Arable lands accounts for 59% (18,4 million ha) of the total area of the country with a rate of 0.48 ha of arable lands per capita. This numbers shows again the importance of farming with regard to economical and social aspects.

In the West and in the North farms are usually bigger compared to the ones in the South and in the East. In the year 2000 the average acreage of a polish farm was 9.6 hectares (with 8,5 ha of arable land), compared to an average acreage of 18.4 hectares in the EU (in the year 1999). According to a national statistic from 1996 there were 2 041,4 thousand farms in Poland bigger than 1 ha.:

- 49,4 th (2,4%) didn't provide agriculture production
- 260,0 th (12,7%) provided agriculture production for their own use
- 764,4 th (37,4%) provided agriculture production for their own use and surpluses were sold at the market
- 967,5 th (47,4%) produced only for the market

Table 1: The present agriculture holdings structure in Poland

Size of holdings (ha)	Number of holdings in 1000		Arable land of the holdings in 1000 ha	
	1996	2000	1996	2000
1 - 2	462	448	651	645
2 - 3	282	270	690	651
3 - 5	386	345	1 509	1 336
5 - 10	521	448	3 713	3 183
10 - 15	217	185	2 631	2 246
15 - 20	89	83	1 530	1 442
20 - 30	56	62	1 323	1 478
30 - 50	19	27	719	997
50 and more	9	12	1 493	1 532
Total	2041	1880	14 259	13 510

Source: Ministry of Agriculture and Rural Development

The slow process of farm and land concentration ihas been observed over the last four years.

In general the Polish agriculture can still be described as very traditional, multifunctional and extensive. This type of farming allows to preserve a diverse landscape and rich biodiversity. This provides a basis for the development of organic farming on a larger scale.

In Poland organic agriculture has developed since 1990 and in 2001 the organic agriculture bill came into force. It brought official state support for organic farming - farmers receive subsidies per hectare depending on the kind of the cultivated crop and refunding of the control costs. So far it has helped to increase the number of farms that have started the conversion process from conventional to organic farming tremendously . Nevertheless there are still not more than 1% of all acreages organic cultivated.

There are five certifying organisations that developed national standards based on IFOAM standards. This certification is performed under state supervision based on the Polish Act on Organic Agriculture, which was ratified in March 2001.

Table 2: The number of organic farms

	2000		2001	
The stage of the control	Number of farms	Area in ha	Number of farms	Area in ha
Certified	405	22 371	669	12 862
II year of transition	41	757	223	7 454
I year of transition	405	13 269	886	18 415
Total	1 279	22 371	1 778	38 731

Source: Ministry of Agriculture and Rural Development

In 2002 there were 44 000 ha under organic cultivation and 1977 organic farms (2% of total number of farms).

4 Pesticide Use

4. 1 Pesticide Market

The new and stricter monitoring method for production and trade of plant protection products (PPP) came into force in Poland in 2002. When the report was prepared, there was only data for the first half of the year (2002) available. Table 3 shows the total amount of PPP sold during this period.

Table 3: The amount of PPP in Poland (sold) in the first half of 2002 (in tonnes)

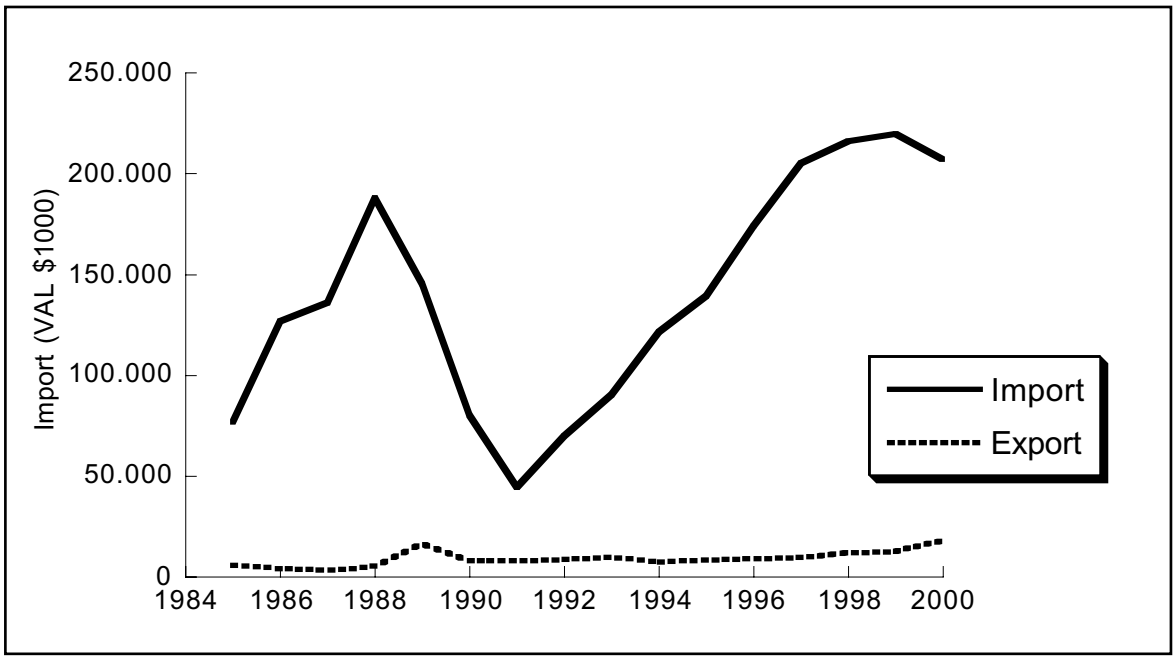
Group of PPP	Total	Produced in Poland	Imported	Stored
Insecticides	1150,48	268,80	881,67	285,10
Herbicides	12391,82	8997,36	3394,45	1741,53
Fungicides	4835,30	1232,23	3603,07	705,18

Table 3: The amount of PPP in Poland (sold) in the first half of 2002 (in tonnes)

Group of PPP	Total	Produced in Poland	Imported	Stored
Plant Growth Regulators	1621,57	675,34	946,22	221,14
Other Uses	159,12	155,04	4,08	35,24
TOTAL	20158,28	11328,79	8829,50	2988,20

Source: Ministry of Agriculture and Rural Development

Figure 1: Import and Export of Pesticides in Poland 1985 - 2000



Source: FAO Database

In contrast to the insignificant export the pesticide import has increased fourfold since 1991.

4. 2 Current application rate of pesticides

Also in 2002 the new system of monitoring of use of pesticides came into force. The system, based on the English example, is much more detailed than the previous one. It is a four-year-cycle of monitoring 10 of the most important Polish crops: potatoes, cereals, legumes, sugar beets, oil plants, fibre plants, corn, vegetables, strawberries and orchards.

In 2002 the use of PPP on potato plantations was monitored and gave very interesting results. Inspectors collected approx. 7.500 questionnaires - every farmer is obliged to record and keep evidence of pesticide application, which gave the base for this analysis. The average use was 3,5 kg/ha (of active ingredient). The research showed also how Poland is divided in terms of pesticide use - a very high amount of PPP in the western part of Poland with about 6 kg/ha and a very low in the eastern part with about 1,5 kg/ha.

The previously collected data for all crops shows a much lower PPP use: 0,5-0,6 kg of active ingredient per ha. The problem of comparing older data with the 2002-data collected is that

the previous monitoring system was very different to the new one and was more based on sale figures then on real application rates . Besides the questionnaires were not obligatory for farmers.

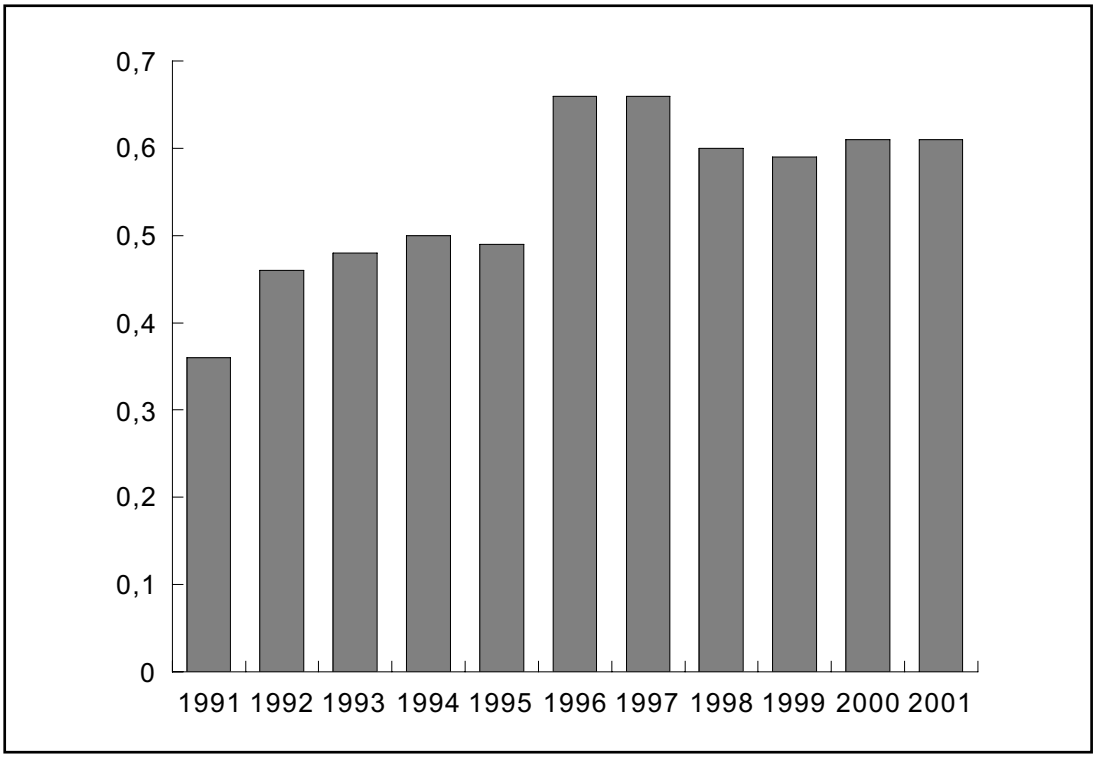
On account of the new monitoring strategy, a detailed overview about the pesticide use in Poland will be available after the four-year-cycle in 2006.

4. 3 Development Within the Last Ten Years

The year 1989 brought big changes in Polish agriculture. From that year on the financial condition of Polish farmers decreased significantly. This process effected also the use of plant protection products. Most of the small farms in southern and eastern Poland faced big financial problems, which resulted in a low use of PPP, because farmers were not able to afford pesticides anymore. A contrary situation was observed in the western and northern parts of Poland. Farms located there are characterised by high levels of production and are also bigger therefore. The first year of monitoring the application of PPP on potatoes gave the picture of a significantly higher use of pesticides there (see figures above).

The average application of pesticides per hectare in Poland during last ten years – according to the data provided by Central Statistics Office – is presented in figure 2.

Figure 2: Pesticide Use in Poland 1991-2001 in kg/ha

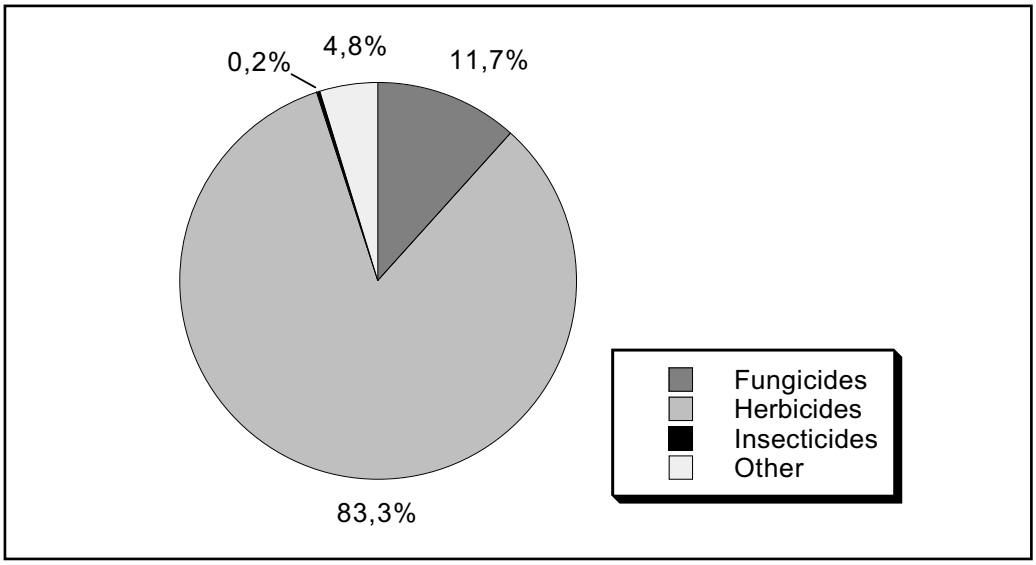


Source: Yearly Book of Central Statistical Office

The most important crops in Poland are cereals, which means that the use of PPP for those crops plays the most significant role in plant protection in Poland. At that time it can be only estimated how the results of the monitoring of PPP for 2004 will turn out and it is yet to early

for a general view of the problem. The 2003-monitoring of potatoes showed that fungicides were the most commonly used pesticide, with a share of 86% of all applied active ingredients.

Figure 3: Plant protection products sold in Poland in the first half of 2002



Source: Ministry of Agriculture and Rural Development

5 Pesticides - Law and Policies

The Ministry of Agriculture and Rural Development is responsible for monitoring and authorisation of plant protection products. Its enforcement agency is the Plant Protection and Seed Service. It monitors the use of PPP and participates in the authorisation process of new pesticides. The Plant Protection Institute, with the main office in Poznan manages the scientific part of PPP monitoring.

The authorisation of new PPP is also consulted with the Ministry of Health through the National Institute of Hygiene and the Ministry of Environment through the Main Inspection for Environmental Protection.

The most important law considering PPP is the Act from 12 July 1995 on the protection of cultivated plants, amended by Act of 16 February 2001. Its subject is plant protection in general, it gives obligations for the farmers (i.e. providing the evidence of measures) and for controlling institutions - i.e. monitoring of PPP use.

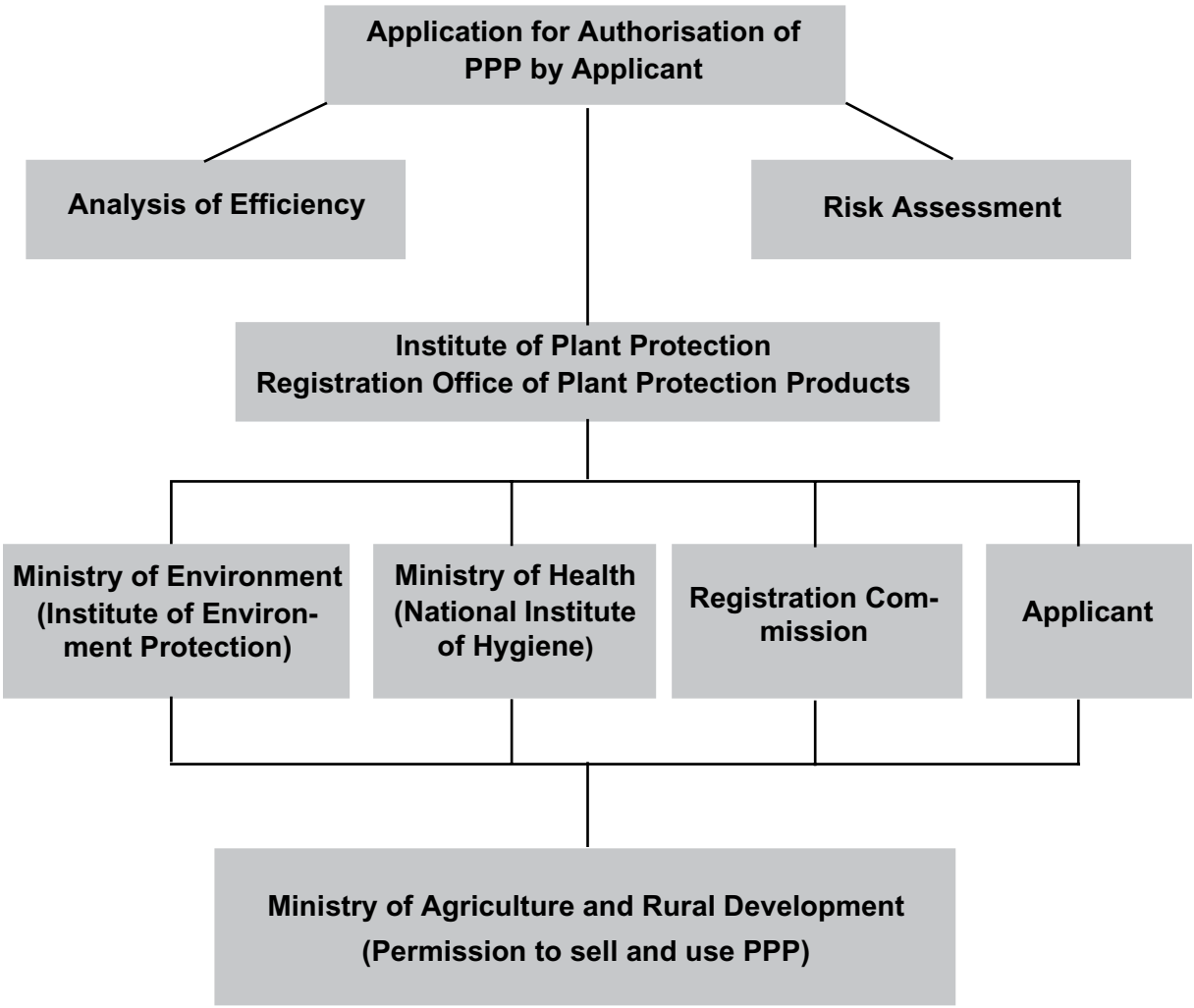
The Degree of the Minister of Agriculture and Rural Development from 5 March 2002, concerning detailed principles of granting authorisation for the placement of plant protection products on the market, is a very important document for the authorisation process. It is the performance law for the Act on protection of cultivated plants, and gives recommendations for the PPP authorisation process - requirements for applications, documents needed to register PPP, PPP analyses that need to be done before registration, institutions responsible for the process, the rules of PPPs qualification regarding their toxicity, and it names institutions which are responsible for the qualification and the labelling of PPPs. It also defines active ingredients forbidden in use; those that can be hazardous for people, animals and environment and the limitation range of using PPPs containing those substances.

Those two laws were created to harmonise Polish law with EU laws. Unfortunately the changes made in the Act on protection of cultivated plants amended in 2001 do not fully harmonise with the Directive 91/414. Therefore the Division of Plant Production of the Ministry of Agriculture and Rural Development continues its work on a new act. The draft of this new act was already announced for April 2003.

Before its approval the effectiveness of any plant protection product is checked by the Agricultural Research Institutes. The Institute for Plant Protection elaborates the label for crops, pests and doses, as well as for safety and waste disposals. The National Institute of Hygiene and the Institute of Environmental Protection evaluate if PPPs are secure in reference to the human health and the environment. PPPs will only be approved, marked and used if they are not posing any threat to human and animal health, nor to the environment.

A Committee for Authorisation of Plant Protection Products, advisory body of the Minister of Agriculture and Rural Development has been established, too. A list of plant protection products approved for trade and use is published each year in 'Monitor Polski'– a publication issued by the government. The authorisation for every plant protection product is given for three years.

Figure 4: Institutions involved in the authorisation process.



The rules in the above laws are very similar in to the ones in theEU, because all the amendments were resolved in order to harmonise with EU laws. There are still some differences, which will be probably changed in the new law - unfortunately NGOs still have no access to this project. The most important differences are: there is no designated co-ordinating authority, no legal frames for monitoring the quality of PPPs already registered – being on the market; and residues in the plant material in the detail trade. The monitoring of residues in environment is not very well developed and is still very random.

It is very important to have an efficient control system of plant protection products in Poland. The harmonisation with EU legislation should help to improve this plan. Table 4 shows the significant increase of PPPs on the Polish market.

Table 4 shows the significant increase in number of PPPs on the Polish market.

Table 4: Number of registered PPPs (from the beginning of authority system)

Year	1965	1974	1984	1994	1999	2002
Number of registered PPPs	190	178	330	523	824	1113

The information about above processes is available in extension centres, Inspectorate of Plant Protection and at the Ministry of Agriculture and Rural Development. Some of them are available online at www.minrol.gov.pl and in specialist literature. But it is not very easy to obtain that kind of data and information in Poland.

5. 1 Pesticide use and control

Good Agriculture Practice

The Code of Good Agriculture Practice (GAP) has been in force in Poland since 1999. The GAP contains a lot of useful information about pesticide use as well as Polish Acts and Decrees, European Union Directives, international conventions and HELCOM Recommendations. In the GAP farmers can find very detailed instructions how to spray the pesticides and how to treat the equipment after spraying. Special advisors from extention services encourage farmers to implement GAP.

Integrated Fruit Production (IFP) has existed in Poland for 11 years, whereas in the first five years it included apple orchards only. In the following years guidelines for strawberries (1995), pears (1997) and cherries (1999) were also elaborated. When IFP was introduced a special attention was paid to activity and initiative of individual IFP groups. There are no other ICM/ IMP programs in Poland.

All products sold in Poland need a licence. A licence is required for each purchaser and user of plant protection product, described as very toxic or toxic for humans. Companies trading plant protection products and authorised local advisory units carry out permanent education of farmers. The Main and Regional Plant Protection and Seed Services inspect the actions taken.

All this requirements are described in the following Acts:

- Act of 12 July 1995 on protection of cultivated plants amended by the Act of 16 February 2001 (Journal of Laws)

- Decree of the Minister of Agriculture and Food Economy of 20 September, 2001 about detailed demands from a training unit (Journal of Laws no 114, 1222)

According to:

- Decree of Minister of Agriculture and Rural Development of 4 October 2001 on technical requirements for sprayers (Journal of Laws, No 121, 1303)
- Handbook of Plant Protection

Plant protection products must be used only for purposes strictly defined on the label and exactly according to the recommendation given therein. Users of plant protection products are obliged to keep records of treatments made. The records should be kept for a period of at least 4 years.

Equipment

The Main and Regional Plant Protection Inspectorates are responsible for implementation, inspection and control. Up to the end of 2001 there were 250 local testing stations established, which have controlled up to now some 20% of actually utilised PPP sprayers.

6 Pesticides - Impacts and Monitoring

Monitoring of pesticides residues in food, water and soil is under the responsibility of three Ministries: Ministry of Agriculture and Rural Development - in fresh agriculture products, Ministry of Health - in processed food and drinking water, Ministry of Environment - in soil and surface water. On behalf of these Ministries the control is done by Plant Protection and Seed Service, Sanitary Inspection and State Inspection for Environment Protection. Unfortunately this monitoring is not very well developed.

The Institute of Plant Protection monitors agriculture crops for Plant Protection and Seed Service as ordered by Act of 12 July 1995 on protection of cultivated plants amended by Act of 16 February 2001. The same as mentioned before. Another important legislation is the Decree of the Minister of Health and Social Care from 8 October 1993 concerning Maximum Residues Levels in food of chemical means used during cultivating, protecting, storaging and transporting of plants in food, amended on 7 May 2001. It defines MRLs for fruits and vegetables, milk and meat. The quality of other food products and drinking water is controlled by Sanitary Inspection on behalf of the Ministry of Health. The plan of the priority product list where the pesticide residues are analyzed is prepared every year by the Main Sanitary Inspection. All food products sold in Poland have to correspond with Act from 11 May 2001 about health conditions of food and alimentation. When the report was prepared the new food monitoring system was constructed but the priorities were not given yet. The authors were told that the pesticides would play an important role in this system but the substances to be analysed were not defined yet.

The monitoring of surface water is provided by the State Inspection for Environment Protection on behalf of Ministry of Environment. The monitoring is based on the following two laws: Act of 18 July 2001 - Water Law, Act of 27 April 2001 – Environment Protection Law.

The analyses of soil regarding pesticides residues are also provided, but there is no regular monitoring, because it is not demanded by Polish law. These soil analyses are under the resposibility of the Institute of Plant Protection.

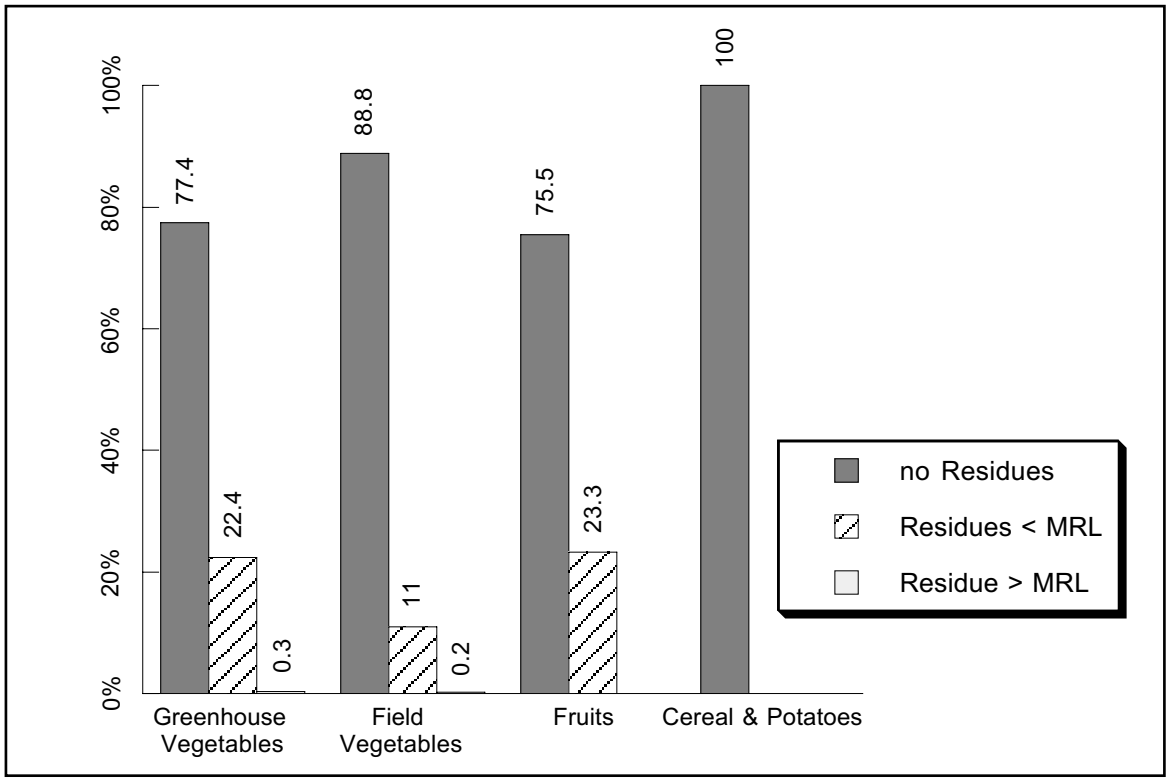
The only information easy to provide is the one concerning pesticide residues in food (samples). Such information can be found in the Yearly Book of the Central Statistical Office and concerns residues in plants/vegetables and fruits, some kind of juice, animal fat and fish.

The control of crops is performed randomly in accordance with monthly plans elaborated by each of the Regional Plant Protection Inspectorates. Overall the country annually approximately analyses 3000 samples of crops for residues of active substances.

The following active ingredients were analysed:

- **Insecticides**: Cypermethrin (alfa-), Bifenthrin, Chlorpyrifos, Lambda Cyhalothrin, Cypermethrin, p,p'-DDE, p,p'-DDT, Deltamethrin, Diazinon, Dimethoate, Endosulfan, Fenitrothion, phosalone, Lindane (g-HCH), Methoxychlor, HCB, _-HCH, b-HCH, Pirimicarb
- **Fungicides**: azoxystrobin, benomyl, bupiirmate, chlorothalonil, cyprodinil, dichlofluanid, dithiocarbamate, fenarimol, flusilazole, iprodione, captan, carbendazim, metalaxyl, procymidone, pyrimethanil, methylthiophanate, tolyfluanid, triadimefon, trifloxystrobin, vinclozolin
- **Herbicides**: Atrazine, Linuron, Metribuzin, Pendimethalin, Simazine

Figure 5: Pesticides Residues in Crops in 2001



Source: the Yearly Book of Central Statistical Office (2002)

The results of the analyses of 2001 showed that only 0,1% of the samples had residues above MRL what – comparing to the year 2000 and 1999 – is a slightly decreasing tendency (0,5% in 1999 and 2000).

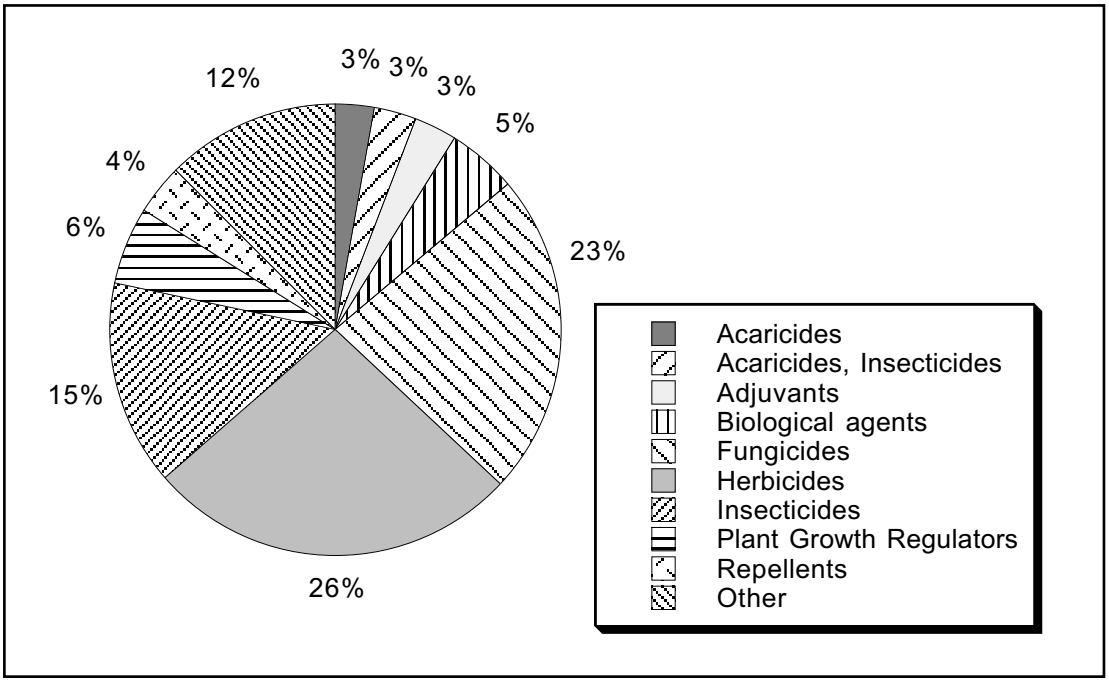
Meanwhile there are some differences between Polish and EU regulations concerning MRL. According to European standards 1,1% , and not 0,1%, of all analysed samples had residues above MRL.

In the same time the total amount of samples without residues was 81,4%, but up to 24% of the analysed samples contained residues above MRL. The amount of multiple residues (more than one active ingredient in a sample) is not known.

7 Characterisation of Authorized Pesticides in Poland

The list of the pesticide active ingredients authorized in Poland was obtained from the Polish Plant Protection Institute. The list dated 31.12.2001, includes 385 substances authorised for the use in pesticide products and 63 pesticide active ingredients which are banned in Poland. Use types were assigned to the 385 substances. Substances which are not pesticide active ingredients such as adjuvants, plant growth regulators and beneficial insects are also listed. Figure 6 shows the Major use types of these 385 substances.

Figure 6: Major use types of Substances authorized for the use in Pesticide Products



Source: Plant Protection Institute Poland

Figure 6 summarises the major use types, Table 5 presents the specific type of use and the number of substances assigned.

Table 5: Authorized Substances and their Use Types

Use Type	Abbreviation	Number of Substances
Major Use Types		
Acaricides	AC	11
Acaricides, Insecticides	AC, IN	12
Adjuvants	AD	12
Biological agents	AB	19
Fungicides	FU	87
Herbicides	HB	103
Insecticides	IN	56
Plant Growth Regulators	PG	23
Repellents	RE	14
Other Use Types		48
Acaricides, Fungicides	AC, FU	1
Acaricides, Fungicides, Nematicides	AC, FU, NE	1
Adjuvants, Insecticides, Acaricides	AD, IN, AC	1
Bacteriocides	BA	5
Bacteriocides, Fungicides	BA, FU	6
Bacteriocides, Fungicides, Herbicides	BA, FU, HB	3
Bacteriocides, Fungicides, Insecticides	BA, FU, IN	1
Fungicides, Insecticides, Nematicides, Herbicides	FU, IN, NE, HB	1
Fungicides, Nematicides, Plant Growth Regulators	FU, NE, PG	1
Herbicides, Acaricides, Insecticides, Nematicides, Fungicides, Rodenticide	HB, AC, IN, NE, FU, RO	1
Insecticides, Acaricides	IN, AC	2
Insecticides, Nematicides	IN, NE	2
Insecticides, Rodenticide	IN,RO	1
Molluscicides	MO	3
Nematicides, Fungicide, Bacteriocide, Herbicide	NE, FU, BA, HB	1
Nematicides, Insecticide	NE, IN	1
Not specified	Not spec.	10
Not specified, Insecticide	Not spec., IN	1
Plant Growth Regulators, Herbicide	PG, HB	1
Repellents, Fungicides	RE, FU	1

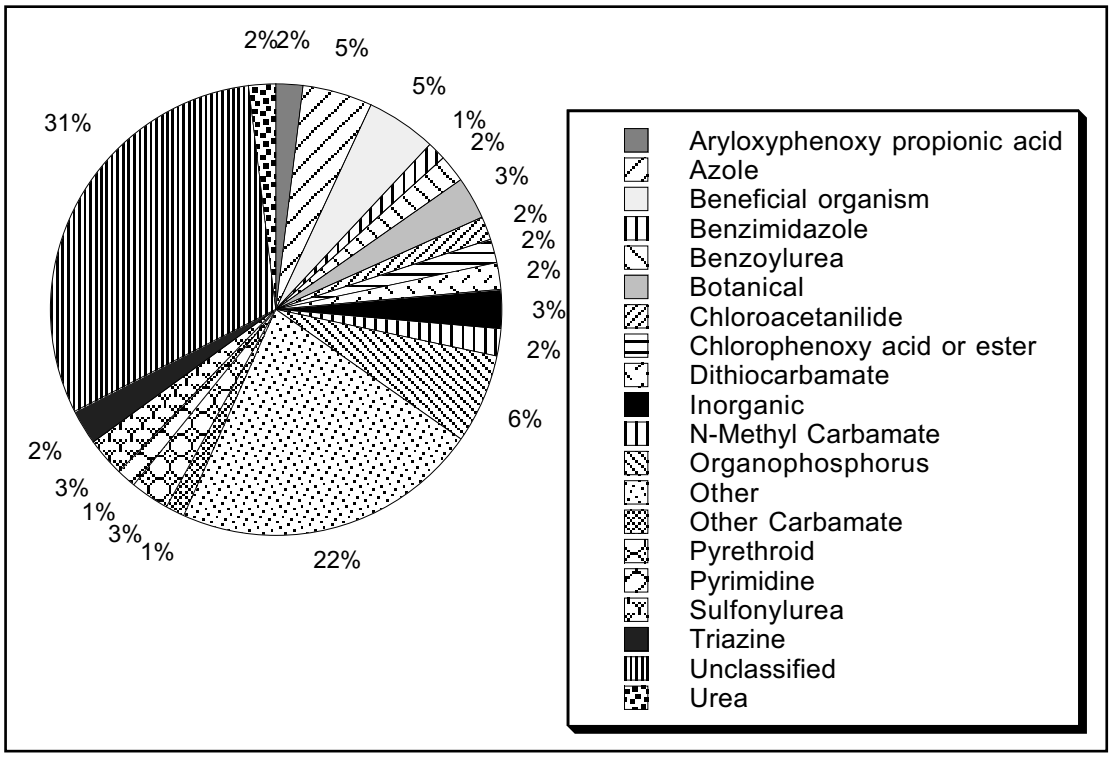
Table 5: Authorized Substances and their Use Types

Use Type	Abbreviation	Number of Substances
Repellents, Molluscicides	RE, MO	1
Rodenticide	RO	3

Source: Plant Protection Institute Poland

The existing database was used to determine the chemical classes of the authorized substances. Figure 7 shows the major chemical classes of the substances. Chemical classes with 4 or less substances are summarised as *Other* in the figure.

Figure 7: Major Chemical Classes of Substances Authorized for Use in Pesticide Products



Appendix 1 lists all 385 substances with their use types and chemical classes.

Recources 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

ChemFinder is a portal of free and subscription scientific database: www.chemfinder.com

Compendium of Pesticide Common Names, lists alphabetically some 1000 pesticides, their use types and chemical classes: www.hclrss.demon.co.uk

8 Regulatory Status

All substances listed in Appendix 1 are registered for use the in Poland. Two active ingredients, *endosulfan, atrazine*, and all other authorized active ingredients which belong to the chemical class of the Dithiocarbamates (*mancozeb, maneb, metam-sodium, metiram, propineb* and *thiram)* are restricted for the use in pesticides (RUP). The use of *endosulfan* is only allowed to control mites, the application of *atrazine* is limited to 1,5 kg per ha, and the application of Dithiocarbamates is forbidden on lettuce and on hops after flowering.

In the European Union two 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. The 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.[1] 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.[2]

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 Poland 25 new active ingredients received authorization.

In Poland 15 of the 20 Annex 1 pesticides are authorized. For 60 pesticides, which are authorized in Poland, authorization will expire in July 2003 in the European Union. 201 of the pesticides authorized in Poland are still in the re-evaluation process.

Appendix 1 lists the 385 pesticide authorized in Poland 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.

1 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

2 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

Recources to Directive 91/414:

European Commission Food Safety website on pesticide authorization:

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

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.[3] Table 6 presents substances listed in Annex X of Directive 2000/60/EEC, which are ingredients of pesticide products, and their regulatory status in Poland.

Table 6: Priority Substances Used as Pesticide or in Pesticide Products and their Regulatory Status in Poland

Substance	Use type	Priority Substance	Priority & Dangerous Substance	Authorized in Poland
Alachlor	Herbicide	Yes		Yes
Atrazine	Herbicide	Yes	Yes***	RUP
Benzene	Solvent	Yes		No
Chlorfenvinphos	Insecticide	Yes		Yes
Chloroform	Solvent, Fumigant	Yes		Banned
Chlorpyrifos	Insecticide	Yes	Yes***	Yes
Diuron	Herbicide	Yes	Yes***	Yes
Endosulfan	Insecticide	Yes	Yes***	RUP
Endosulfan - alpha	Insecticide			No
Ethylene dichloride	Fumigant, Insecticide	Yes		No
Hexachlorobenzene	Fungicide, Microbiocide	Yes	Yes	Banned

3 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 6: (continued)Priority Substances Used as Pesticide or in Pesticide Products and their Regulatory Status in Poland

Substance	Use type	Priority Substance	Priority & Dangerous Substance	Authorized in Poland
Hexachlorocyclohexane	Insecticide	Yes	Yes	Banned
Isoproturon	Herbicide	Yes	Yes***	Yes
Lindane	Insecticide	Yes		Banned
Methylene chloride	Solvent	Yes		No
Naphthalene	Insecticide	Yes	Yes***	No
Nonyl phenol	Adjuvant		Yes	No
PCP	Wood Preservative, Microbiocide, Algaecide, Fungicide		Yes***	Banned
Pentachlorobenzene	not specified			banned
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

Recources to Directive 76/464:

Website of the 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 banned in Poland. The Stockholm Convention was signed in May 2001, to enter into force it now has to be ratified by at least 50 countries. Poland was one of the signung countries, but has not yet ratified the convention.[4]

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

4 UNO website: http://www.unece.org/env/lrtap/status/98pop_st.htm

chemical industry associations. Poland signed and but has not ratified the convention so far.[5] 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.[6] Table 7 list all PIC pesticide, their type of use, and their regulatory status in Poland.

Table 7: PIC Pesticides and their Status of Authorization in Poland

Pesticide	Use Type	PIC Pesticide	Authorized in Poland
2,4,5-T	Herbicide	Yes	Banned
2-Fluoroacetamide	Rodenticide, Insecticide	Yes	No
Aldrin	Insecticide	Yes	Banned
Binapacryl	Herbicide	Yes	Banned
Captafol (isomer unspec.)	Fungicide	Yes	Banned
Carbofuran	Insecticide	Candidate	Yes
Chlordane	Insecticide	Yes	Banned
Chlordimeform	Insecticide	Yes	Banned
Benomyl	Fungicide	Candidate	Yes
DDT	Insecticide	Yes	Banned
Dieldrin	Insecticide	Yes	Banned
Dinoseb	Herbicide, Defoliant	Yes	Banned
Ethylene dibromide	Fumigant	Yes	Banned
Ethylene dichloride	Fumigant, Insecticide	Yes	No
Ethylene oxide	Fumigant	Yes	Banned
Heptachlor	Insecticide	Yes	Banned
Hexachlorobenzene	Fungicide, Microbiocide	Yes	Banned
Hexachlorocyclohexane (HCH)	Insecticide	Yes	Banned
Lindane	Insecticide	Yes	Banned
Merpafol cis isomer	Fungicide	Yes	Banned
Methamidophos	Insecticide, Breakdown product	Yes	Yes
Methyl parathion	Insecticide	Yes	Yes
Monocrotophos	Insecticide	Yes	No

5 FAO website: http://www.fao.org/waicent/FaoInfo/Agricult/AGP/AGPP/Pesticid/PIC/convlist.htm
6 www.pic.int

Table 7: PIC Pesticides and their Status of Authorization in Poland

Pesticide	Use Type	PIC Pesticide	Authorized in Poland
Parathion	Insecticide	Yes	Banned
PCP	Wood Preservative, Microbiocide, Algaecide, Fungicide	Yes	Banned
Phosphamidon	Insecticide	Yes	No
Thiram	Fungicide	Candidate	Yes
Toxaphene	Insecticide	Yes	Banned

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 Poland

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)[7] will be used to evaluate the acute toxicity of the pesticide authorized in Poland. 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 Poland can be found in Appendix 2. 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.

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*

7 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

and Environmental Toxicity[8] and from the Risk Study in *From Law to Field - Pesticide Use Reduction in Agriculture - From Pesticide Residue Analyses to Action.*[9]

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

210 of the ingredients authorized in Poland are classified by the WHO: 4 as Extremely Hazardous, 16 as Highly Hazardous, 40 as Moderately Hazardous, 57 as Slightly Hazardous and 102 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.[10] 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 8. 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[11] [12] is neglected in this calculation. Health effects other than acute toxicity, such as carcinogenicity, have been taken into account for many compounds; the classification has been accordingly adjusted.

Table 8: 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

8 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

9 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

10 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

11 "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 12.)

12 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

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 Poland are listed in the WHO classifications. The acute toxicity classification of them can be found in Appendix 2.

9. 2 Acute Toxicity - European Union

154 of the ingredients authorized in Poland are classified by the European Union: 23 as Very Toxic, 31as Toxic, 69 as Harmful and 15 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.[13] 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.[14] 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.[15] The classification system of the EU goes further than the WHO acute toxicity classification. The combination of danger symbols 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.

13 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

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

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

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 Poland, 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 9: 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

32 of the ingredients authorized in Poland 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.[16]

16 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

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*[17] *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...."*[18]

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.[19]

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

17 Reference Dose, (note of the author)

18 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

19 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

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)

24 of the ingredients authorized in Poland are evaluated by the IARC: 1 is classified as probably carcinogenic to humans, 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.[20]

The evaluation leads to a classification which is divided into five groups as displayed in the Table 10.

Table 10: 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.

One ingredient registered in Poland, *formaldehyde,* 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 Poland are classified as possibly carcinogenic to humans (Group 2B). This classification is applied when limited evidence of carcinogenicity in humans

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

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.[21]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.[22] 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 11: 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.
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.

21 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

22 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 12: 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: 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: 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 13: 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: 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 The mode(s) of carcinogenic action and associated key events have been identified in animals, and 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: EPA (2000): List of Chemicals Evaluated for Carcinogenic Potential

Appendix 2 lists pesticides authorized in Poland 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

18 of the ingredients authorized in Poland cause concern for humans due to possible carcinogenic effects and have been placed into the carcinogenicity category 3 by the EU. 4 *cause concern for humans owing to possible mutagenic effects and have been placed into the mutagenicity category 3*; *and 5 may cause harm to the unborn child and 10 present possible risks of harm to the unborn child.*

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.[23] In the 18th amendment[24] 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.[25] 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 manufacturer 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 14. There are inherent difficulties in assigning substances into Category 1 due to the fact that this is done on the basis of epidemiological data.[26] Therefore it seems to be impossible to clas-

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 (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

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

sify 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.

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 14: 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; 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 T; R49 May cause cancer by inhalation

26 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

Table 14: EU Classification of Carcinogenic Substances

Category	Description	Symbol & Risk Phrases
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 15. With Directive 2000/32/EEC of 19th May 2000 the European Union modified the Directive 67/548EEC for the 26th time.[27] 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 32) 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.

Four of the Pesticides authorized in Poland have been placed into Category 3. To place a substance in Category 3, positive results are needed in experiments showing mutagenic effects or 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 15: EU Classification of Mutagenic Substances

Category	Description	Symbol & Risk Phrases
Category 1	Substances known to be mutagenic to humans. 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.

27 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

Table 15: EU Classification of Mutagenic Substances

Category 2	Substances which should be regarded as if they are mutagenic to humans. 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.[28]

Table 16: EU Classification of Substances Toxic to Reproduction

Category	Description	Symbol & Risk Phrases
Category 1	1. Substances known to impair fertility in humans. 2. Substances known to cause developmental toxicity in humans.	T; R60: May impair fertility. T; R61: May cause harm to the unborn child.
Category 2	1. Substances which should be regarded as if they impair fertility in humans. 2. Substances which should be regarded as if they cause developmental toxicity to humans.	T; R60: May impair fertility. T; R61: May cause harm to the unborn child.
Category 3	1. Substances which cause concern for human fertility. 2. Substances which cause concern for humans owing to possible developmental toxic effects.	Xn; R62: Possible risk of impaired fertility. Xn; R63: Possible risk of harm to the unborn child.

28 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

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.[29]

The ADI values can be found in Appendix 2. For 106 of the valuated pesticides an ADI value has been assigned.[30]

29 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)

30 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

California Department of Resticide 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

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.[31] 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

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

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.[32] 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.[33] 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 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.[34]

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*.[35] In this study 564 substances were reviewed concerning their potential endocrine disrupting properties. The expert meeting created

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

33 ibid 31

34 ibid 31

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 Poland, which have been reviewed by the EU, as well as those reviewed by other scientists.

Appendix 3 lists the ingredients authorized in Poland 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 72 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.

Resources to endocrine disruption:

Selected world wide web resources on endocrine disruptors maintained by the National Resources Defense 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

11 Environmental Toxicity

121 ingredients authorized in Poland are classified as “Dangerous for the Environment” and 111 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 bare-

35 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

ly be explained at the current stage of scientific knowledge.[36] 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 Poland 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.[37] The classification of dangerous substances regarding their environmental hazards can be found in the amendment paper 393L002131[38] (Commission Directive 93/21/EEC of 27 April 1993), a modification to the directive 67/548/ EEC. The present criteria of this classification refer to aquatic ecosystems, but it is acknowledged that certain substances may affect other ecosystems as well. Table 17 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.

36 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

37 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

38 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

Table 17: 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[39] 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[40] 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.

39 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

The EU Symbols and Risk Phrases of the ingredients authorized in Poland 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.[41]

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.[42]

Since the health hazards of the pesticides authorized in Poland 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

40 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

41 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

42 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

mean low impact, high values the opposite. The parameter, the applied rating system and the main data sources are displayed in Table 18.

Table 18: Rating System for the Environmental Impact Quotient

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

For 116 ingredients authorized in Poland the ecological impact according to the model of Cornell University has been calculated. The list of the ingredients authorized in Poland 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 most comprehensive online database on pesticides: www.pesticideinfo.org

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

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

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

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 Poland 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[44] 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 test-

43 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

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

ed 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.[45] Those data were considered 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[46] (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

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

46 Only very few pesticides were tested, mostly organochlorines.

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 87 pesticides detected as residues in German food and water, which are authorized as pesticide in Poland.

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,
- 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[47]
- typically extract only 30-90% of the residues present,[48]
- do not cover all breakdown products,
- do not cover ‘inert’ ingredients,[49] and
- may vary from year to year due to improved technologies, that can detect lower concentrations.

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

48 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

49 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.

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.[50] 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.[51]

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

13 Summary

In Poland agriculture plays a dominant role. Almost 60 % of its area is arable land and some 19% of the employed inhabitants work in agriculture, hunting and forestry. Due to little resources many farmers do not use agrochemicals, but in areas with fertile soils, agriculture is going to be intensified.

During the last ten years pesticide policy has changed considerably in Poland. A Code on Good Agricultural Practice was enforced and the authorisation process was re-organised. Integrated Fruit Production was implemented for important fruits.

In the year 2001 some 385 pesticide active ingredients, plant growth regulators and other substance used in crop protection were registered in Poland. The evaluation of these substances according to international classification system showed that:

- 7 substances are priority substances according to the European Water Framework Directive;
- 2 are PIC pesticides;
- 154 of the ingredients authorized in Poland are classified by the European Union: 23 as highly toxic, 31 as toxic, 69 as Harmful and 15 as irritant;
- 210 of the ingredients authorized in Poland are classified by the WHO: 4 as extremely hazardous, 16 as highly hazardous, 40 as moderately

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

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

hazardous, 57 as slightly hazardous and 102 as unlikely to present hazard in normal use;

- 32 of the ingredients authorized in Poland are cholinesterase inhibitors (ChE);
- 121 ingredients authorized in Poland are classified as “Dangerous for the Environment” and 111 have been assigned with the Symbol “N;”
- 18 of the ingredients authorized in Poland cause concern for humans, due to possible carcinogenic effects and have been placed into the carcinogenicity category 3 by the EU. 4 cause concern for humans, owing to possible mutagenic effects and have been placed into the mutagenicity category 3; and 5 may cause harm to the unborn child and 10 present possible risks of harm to the unborn child.

With accession to the European Union in 2004 and in compliance with EU Directive 91/414 EC authorization for 60 active ingredients will expire in Poland.

Appendix 1 - Identification and Regulatory Status

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
Agrobacterium radiobacter	-			AB	Beneficial organism				
Amblyseius californicus	-			AB	Beneficial organism				
Amblyseius cucumeris	-			AB	Beneficial organism				
Aphidius colemani	-			AB	Beneficial organism				
Aphidoletes aphidimyza	-			AB	Beneficial organism				
Bacillus thuringiensis	-			AB	Beneficial organism				
Baculovirus GV	-			AB	Beneficial organism				
Coniothyrium minitans	-			AB	Beneficial organism		new ai		
Dacnusa sibirica	-			AB	Beneficial organism				
Diglyphus isaea	-			AB	Beneficial organism				
Encarsia formosa	-			AB	Beneficial organism				
Heterorhabditis megidis	-			AB	Beneficial organism				
Macrolophus caliginosus	-			AB	Beneficial organism				
Orius insidiosus	-			AB	Beneficial organism				
Phlebiopsis gigantea	-			AB	Beneficial organism				
Phytoseiulus persimilis	-			AB	Beneficial organism				
Pythium oligandrum	-			AB	Beneficial organism				
Steinernema feltiae	-			AB	Beneficial organism				
Therodiplosis persicae	-			AB	Beneficial organism				
azocyclotin	41083-11-8	255-209-1	404	AC	Organotin		Notified		
bromopropylate	18181-80-1		503	AC	Benzilate		Out 7/03		
clofentezine	74115-24-5		418	AC	Unclassified		Notified		
cyhexatin	13121-70-5	236-049-1	289	AC	Organotin		Notified		
fenazaquin	120928-09-8	410-580-0	8149	AC	Unclassified		Notified		
fenbutatin oxide	13356-08-6	236-407-7	359	AC	Organotin		Notified		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
fenpyroximate	111812-58-9			AC	Unclassified				
hexythiazox	78587-05-0	-	439	AC	Unclassified		Notified		
propargite	2312-35-8	219-006-1	216	AC	Unclassified		Notified		
tebufenpyrad	119168-77-3		8320	AC	Pyrazole		Notified		
tetradifon	116-29-0		113	AC	Other		out		
dinocap	39300-45-3	254-408-0	98	AC, FU	Dinitrophenol derivative		pending		
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		
dichlorvos	62-73-7	200-547-7	11	AC, IN	Organophosphorus		Notified		
endosulfan	115-29-7	204-079-4	89	AC, IN	Organochlorine	RUP	pending	P	
flufenoxuron	101463-69-8		470	AC, IN	Benzoylurea		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		
aldicarb	116-06-3	204-123-2	215	AC, IN, NE	N-Methyl Carbamate		pending		
phosalone	2310-17-0	218-996-2	109	AC,IN	Organophosphorus		Notified		
pirimiphos-methyl	29232-93-7	249-528-5	239	AC,IN	Organophosphorus		Notified		
pyridaben	96489-71-3	405-700-3	583	AC,IN	Unclassified		Notified		
vamidothion	2275-23-2	218-894-8	117	AC,IN	Organophosphorus		Out 7/03		
alkylarylpolyglycolic ether	-			AD	Unclassified				
alkylbenzenesulfonic acid	-			AD	Unclassified				
alkyldimethylpolioxyethylen-ammonium hydroxylate	-			AD	Unclassified				
alkylphenol ethoxylate	-			AD	Unclassified				
ammonium sulfate	7783-20-2		8015	AD	Inorganic				
fatty amine alkoxylated	-			AD	Unclassified				
glycoldiethylene	-			AD	Unclassified				

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
isodecylalcohol ethoxylate	-			AD	Unclassified				
oilseed rape methyl esters	-			AD	Unclassified				
Poly-p-Methene	-			AD	Unclassified				
polysacharide	-			AD	Carbohydrate				
vegetable oil	8008-89-7			AD	Oil - vegetable				
petroleum oils	68815-10-1		29	AD,IN,AC	Petroleum derivative				
chlorine as sodium hypochlorite	-			BA	Unclassified				
formaldehyde	50-00-0	200-001-8	156	BA	Unclassified				
hypochlorite sodium	7681-52-9	231-668-3	8300	BA	Inorganic		not listed		
peracetic acid	79-21-0	201-186-8		BA	Inorganic				
streptomycin	57-92-1		312	BA	Unclassified		Notified		
boric acid	10043-35-3		8033	BA, FU	Inorganic				
bradophen	-			BA, FU	Unclassified				
copper hydroxide	20427-59-2		8074	BA, FU	Inorganic-Copper		Notified		
copper oxychloride	1332-40-7		8076	BA, FU	Inorganic-Copper		Notified		
dimethylbenzoylammonium chloride	5538-94-3			BA, FU	Quaternary Ammonium Compound		not listed		
ethanoltriazine	-			BA, FU	Unclassified				
didecyldimethylammonium chloride	7173-51-5	230-525-2	8104	BA, FU, HB	Quaternary Ammonium Compound		not listed		
glutaric aldehyde	111-30-8	203-856-5	8169	BA, FU, HB	Unclassified		not listed		
glyoxal	107-22-2	203-474-9		BA, FU, HB	Unclassified				
garlic	8000-78-0			BA, FU, IN	Botanical				
2-mercaptobenzothiazolate-sodium	149-30-4	205-736-8		FU	Mercaptobenzothiazole				

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
azaconazole	60207-31-0	262-102-3		FU	Azole		Out 7/03		
azoxystrobin	131860-33-8	-		FU	Strobin		Annex 1		
benalaxyl	71626-11-4		416	FU	Xylylalanine		out		
benomyl	17804-35-2	241-775-7	206	FU	Benzimidazole		pending		
biohumus	-			FU	Unclassified				
bitertanol	55179-31-2		386	FU	Azole		Notified		
bromuconazole	116255-48-2		8036	FU	Azole		Notified		
bupirimate	41483-43-6		261	FU	Pyrimidine		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		
chlorothalonil	1897-45-6	217-588-1	288	FU	Substituted Benzene		pending		
copper sulfate tribasic	-		8079	FU	Inorganic-Copper		Notified		
cumylphenylate	-			FU	Unclassified				
cymoxanil	57966-95-7	261-043-0	419	FU	Unclassified		Notified		
cyproconazole	94361-06-5	-	600	FU	Azole		Notified		
cyprodinil	121552-61-2		511	FU	Unclassified		Notified		
dichlofluanid	1085-98-9	214-118-7	74	FU	Sulfonamide		Out 7/03		
difenoconazole	119446-68-3		8107	FU	Azole		Notified		
dimethomorph	110488-70-5	404-200-2	483	FU	Unclassified		Notified		
diniconazole-M	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	Unclassified		Notified		
epoxiconazole	106325-08-0	406-850-2	609	FU	Unclassified		Notified		
ethirimol	23947-60-6	245-949-3	242	FU	Pyrimidine		Out 7/03		
famoxadone	131807-57-3			FU	Unclassified		Annex I new ai		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
fenamidone	161326-34-7			FU	Unclassified		new ai		
fenarimol	60168-88-9	262-095-7	380	FU	Pyrimidine		pending		
fenhexamid	126833-17-8			FU	Unclassified				
fenpropimorph	67306-03-0		427	FU	Unclassified		Notified		
fentin hydroxide	76-87-9	200-990-6	490	FU	Organotin		out		
fluazinam	79622-59-6		521	FU	2,6-Dinitroaniline		Notified		
fludioxonil	131341-86-1		522	FU	Unclassified		Notified		
fluquinconazole	136426-54-5	411-960-9	474	FU	Azole		Notified		
flusilazole	85509-19-9	-	435	FU	Azole		pending		
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		
fuberidazole	3878-19-1	223-404-0	525	FU	Benzimidazole		Notified		
furalaxyl	57646-30-7	260-875-1	433	FU	Xylylalanine		Out 7/03		
grapefruit (extract from seeds and pomace)	-			FU	Botanical				
guazatine acetate	115044-19-4			FU	Unclassified				
hymexazol	10004-44-1	233-000-6	528	FU	Unclassified		Notified		
imazalil	35554-44-0	252-615-0	335	FU	Azole		Annex I		
iprodione	36734-19-7	253-178-9	278	FU	Dicarboximide		Annex I		
iprovalicarb	140923-17-7			FU	Unclassified		Annex I new ai		
isobutyric acid	79-31-2	201-195-7		FU	Unclassified				
kresoxim-methyl	143390-89-0	-		FU	Strobin		Annex I		
lecithin	8002-43-5		8201	FU	Unclassified				
mancozeb	8018-01-7	-	34	FU	Dithiocarbamate	RUP	pending		
maneb	12427-38-2	235-654-8	61	FU	Dithiocarbamate	RUP	pending		
metalaxyl	57837-19-1		365	FU	Xylylalanine		out		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
metalaxyl-M	70630-17-0	-		FU	Xylylalanine		Annex I new ai		
metconazole	125116-23-6		8210	FU	Azole		Notified		
metiram	9006-42-2		478	FU	Dithiocarbamate	RUP	pending		
myclobutanil	88671-89-0	-	442	FU	Azole		Notified		
ofurace	58810-48-3		444	FU	Anilide		Out 7/03		
oxadixyl	77732-09-3		397	FU	Anilide		Out 7/03		
oxine-salicilic copper	10380-28-6		8240	FU	Inorganic-Copper		Out 7/03		
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	Dicarboximide		pending		
propamocarb hydrochloride	25606-41-1			FU	Other Carbamate				
propiconazole	60207-90-1		408	FU	Azole		pending		
propineb	12071-83-9		177	FU	Dithiocarbamate	RUP			
propolis	-			FU	Unclassified				
pyrimethanil	53112-28-0		8270	FU	Pyrimidine		Notified		
quinoxyfen	124495-18-7	-		FU	Unclassified		new ai		
silthiopham	175217-20-6			FU	Unclassified				
spiroxamine	118134-30-8	-		FU	Unclassified				
sulfur	7704-34-9		18	FU	Inorganic				
tebuconazole	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		
thiophanate-methyl	23564-05-8	245-740-7	262	FU	Benzimidazole		pending		
tolclofos-methyl	57018-04-9		479	FU	Organophosphorus		Notified		
tolyfluanid	731-27-1	211-986-9	275	FU	Pheny-Sulfamide		Notified		
triadimefon	43121-43-3	256-103-8	352	FU	Azole		Notified		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
triadimenol	55219-65-3		398	FU	Azole		Notified		
tridemorph	24602-86-6	246-347-3	324	FU	Unclassified		Notified		
trifloxystrobin	141517-21-7			FU	Strobin				
triflumizole	68694-11-1		8346	FU	Azole		Notified		
triforine	37273-84-0			FU	Unclassified				
triticonazole	131983-72-7		652	FU	Azole		Notified		
vinclozolin	50471-44-8	256-599-6	280	FU	Dicarboximide		pending		
zoxamide	156052-68-5			FU	Unclassified		new ai		
dazomet	533-74-4	208-576-7	146	FU, IN, NE, HB,	Unclassified		Notified		
plant extracts	-			FU,NE,PG	Botanical				
2,4-D	94-75-7	202-361-1	1	HB	Chlorophenoxy acid or ester		Annex I		
acetochlor	34256-82-1	251-899-3	496	HB	Chloroacetanilide		Notified		
alachlor	15972-60-8	240-110-8	204	HB	Chloroacetanilide		pending	P	
amidosulfuron	120923-37-7		515	HB	Sulfonylurea		Notified		
asulam	3337-71-1		240	HB	Other Carbamate		Notified		
atrazine	1912-24-9	217-617-8	91	HB	Triazine	RUP	pending	PD	
benazolin	3813-05-6	223-297-0	136	HB	Unclassified		Out 7/03		
bentazone	25057-89-0	246-585-8	366	HB	Others		Annex I		
bromoxynil	1689-84-5	216-882-7	87	HB	Hydroxybenzonitrile		pending		
capric acid	334-48-5			HB	Unclassified				
carbetamide	16118-49-3		95	HB	Carbanilate		Notified		
carfentrazone-ethyl	128639-02-1	-		HB	Unclassified		prov. approval		
chloridazon	1698-60-8	216-920-2	111	HB	Pyridazinone		Notified		
chlorotoluron	15545-48-9		217	HB	Urea		pending		
chlorsulfuron	64902-72-3	265-268-5	391	HB	Sulfonylurea		Notified		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
cinidon-ethyl	142891-20-1			HB	Unclassified		Annex I new ai		
clethodim	99129-21-2		508	HB	Cyclohexenone derivative		Notified		
clomazone	81777-89-1		509	HB	Unclassified		Notified		
clopyralid	1702-17-6	216-935-4	455	HB	Pyridinecarboxylic acid		Notified		
cyanazine	21725-46-2	244-544-9	230	HB	Triazine		out		
cycloate	1134-23-2		214	HB	Thiocarbamate		Out 7/03		
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	120-36-5	204-390-5	84	HB	Chlorophenoxy acid or ester		Out 7/03		
dichlorprop-P	15165-67-0	403-980-1	476	HB	Chlorophenoxy acid or ester		Notified		
diclofop-methyl	51338-27-3	257-141-8		HB	Aryloxyphenoxy propionic acid				
diflufenican	83164-33-4	-	462	HB	Anilide		Notified		
dimefuron	34205-21-5		279	HB	Urea		Out 7/03		
dimethachlor	50563-36-5	256-625-6	8112	HB	Chloroacetanilide		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	
ethofumesate	26225-79-6	247-525-3	233	HB	Unclassified		Annex I		
fenoxaprop-P-ethyl	71283-80-2		484	HB	Aryloxyphenoxy propionic acid		Notified		
ferrous sulfate	7720-78-7		8190	HB	Inorganic				
florasulam	145701-23-1			HB	Unclassified				

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
fluazifop-P-butyl	79241-46-6	-	467	HB	Aryloxyphenoxy propionic acid		Notified		
flufenacet	142549-58-3			HB	Unclassified				
Fluorochloridone	61213-25-0		430	HB	Unclassified		Notified		
fluoroglycofen-ethyl	77501-90-7			HB	Unclassified				
flupyrsulfuron-methyl sodium	144740-54-5	-		HB	Sulfonylurea				
fluroxypyr	69377-81-7	-	431	HB	Unclassified		Annex I		
flurtamone	96525-23-4	-		HB	Unclassified		prov. approval		
glufosinate-ammonium	77182-82-2	278-636-5	437	HB	Unclassified		Notified		
glyphosate	1071-83-6	213-997-4	284	HB	Phosphonoglycine		Annex I		
haloxyfop-R	72619-32-0	406-250-0	526	HB	Aryloxyphenoxy propionic acid		Notified		
imazamethabenz-methyl	81405-85-8		529	HB	Imidazolinone		Notified		
imazamox	11431-32-9			HB	Unclassified				
imazapyr	81334-34-1	-	530	HB	Imidazolinone		Out 7/03		
imazethapyr	81335-77-5		8184	HB	Imidazolinone		Notified		
iodosulfuron methyl-sodium	144550-36-7			HB	Sulfonylurea				
isoproturon	34123-59-6	251-835-4	336	HB	Urea		Annex I	PD	
isoxaflutole	14112-29-0			HB	Unclassified				
lauric acid	143-07-7			HB	Unclassified				
lenacil	2164-08-1		163	HB	Uracil		Notified		
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		
MCPB	94-81-5	202-365-3	50	HB	Chlorophenoxy acid or ester		pending		
mecoprop	93-65-2			HB	Unclassified				

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
mecoprop-P	16484-77-8		475	HB	Chlorophenoxy acid or ester		pending		
metamitron	41394-05-2	255-349-3	381	HB	Triazine		Notified		
metazachlor	67129-08-2		411	HB	Chloroacetanilide		Notified		
metobromuron	3060-89-7		168	HB	Urea		Out 7/03		
metolachlor	51218-45-2		400	HB	Chloroacetanilide		Out 7/03		
metosulam	139528-85-1		8220	HB	Unclassified		Notified		
metribuzin	21087-64-9	244-209-7	283	HB	Triazine		Notified		
napropamide	15299-99-7		271	HB	Amide		Notified		
naptalam	132-66-1		8227	HB	Amide		Out 7/03		
nicosulfuron	111991-09-4		8228	HB	Sulfonylurea		Notified		
oxadiargyl	39807-15-3			HB	Unclassified		Annex I new ai		
oxyfluorfen	42874-03-3		538	HB	Diphenyl ether		Notified		
paraquat dichloride	1910-42-5	217-615-7	56	HB	Bipyridylium		pending		
pendimethalin	40487-42-1	254-938-2	357	HB	2,6-Dinitroaniline		pending		
phenmedipham	13684-63-4		77	HB	Bis-Carbamate		pending		
prometryn	7287-19-6		93	HB	Triazine		out		
propachlor	1918-16-7	217-638-2	176	HB	Chloroacetanilide		Notified		
propaquizafop	111479-05-1		8260	HB	Aryloxyphenoxy propionic acid		Notified		
propisochlor	86763-47-5			HB	Unclassified				
propoxycarbazone-sodium	-			HB	Unclassified				
propyzamide	23950-58-5	245-951-4	315	HB	Amide		pending		
pyridate	55512-33-9	259-686-7	447+B 721	HB	Unclassified		Annex I		
quinmerac	90717-03-6		563	HB	Unclassified		Notified		
quinoclamine	2797-51-5		648	HB	Unclassified		Notified		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
quizalofop-P-ethyl	100646-51-3			HB	Aryloxyphenoxy propionic acid				
quizalofop-P-tefuryl	119738-06-6	414-200-4		HB	Aryloxyphenoxy propionic acid				
rimsulfuron	122931-48-0		8278	HB	Sulfonylurea		Notified		
s-metolachlor	87392-12-9			HB	Chloroacetanilide				
sethoxydim	74051-80-2		401	HB	Cyclohexenone derivative		Out 7/03		
simazine	122-34-9	204-535-2	22	HB	Triazine		pending	PD	
sulcotrione	99105-77-8		8315	HB	Unclassified		Notified		
sulfosulfuron	141776-32-1			HB	Sulfonylurea		Annex I new ai		
terbacil	5902-51-2		272	HB	Uracil		Out 7/03		
terbuthylazine	5915-41-3		234	HB	Triazine		Notified		
terbutryn	886-50-0		212	HB	Triazine		out		
thifensulfuron-methyl	79277-27-3			HB	Sulfonylurea				
tralkoxydim	87820-88-0		544	HB	Cyclohexenone derivative		Notified		
tri-allate	2303-17-5	218-962-7	97	HB	Thiocarbamate		Notified		
triasulfuron	82097-50-5	-	480	HB	Sulfonylurea		Annex I		
tribenuron methyl	101200-48-0	401-190-1	546	HB	Sulfonylurea		Notified		
triclopyr	55335-06-3		376	HB	Chloropyridinyl		Notified		
trifluralin	1582-09-8	216-428-8	183	HB	2,6-Dinitroaniline		Notified	PD	
triflusulfuron-methyl	126535-15-7		8347	HB	Sulfonylurea		Notified		
methyl bromide	74-83-9	200-813-2	128	HB,AC,IN, NE,FU,RO	Halogenated organic		Notified		
acephate	30560-19-1	250-241-2	338	IN	Organophosphorus		out		
acetamiprid	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	PL	Directive 91/414	Water Directive	PIC
benfuracarb	82560-54-1	-	501	IN	Other Carbamate		Notified		
bensultap	17606-31-4	-	464	IN	Unclassified		Out 7/03		
beta-cyfluthrin	68359-37-5	269-855-7	385	IN	Pyrethroid		Annex I		
buprofezin	69327-76-0		8038	IN	Unclassified		Notified		
carbosulfan	55285-14-8	259-565-9	417	IN	N-Methyl Carbamate		Notified		
chlorfenvinphos	470-90-6	207-432-0	88	IN	Organophosphorus		out	P	
chloropicrin	76-06-2	200-930-9	298	IN	Unclassified		Notified		
chlorpyrifos	2921-88-2	220-864-4	221	IN	Organophosphorus		pending	PD	
chlorpyrifos-methyl	5598-13-0		486	IN	Organophosphorus		pending		
cyfluthrin	68359-37-5	269-855-7	385	IN	Pyrethroid		pending		
cypermethrin	52315-07-8			IN	Pyrethroid		Notified		
cyromazine	66215-27-8		420	IN	Triazine		Notified		
deltamethrin	52918-63-5	258-256-6	333	IN	Pyrethroid		Annex I		
diazinon	333-41-5	206-373-8	15	IN	Organophosphorus		Notified		
diflubenzuron	35367-38-5		339	IN	Benzoylurea		Notified		
dimethoate	60-51-5	200-480-3	59	IN	Organophosphorus		Notified		
esfenvalerate	66230-04-4	-	481	IN	Pyrethroid		Annex I		
ethofenprox	80844-07-1		471	IN	Unclassified		Notified		
fatty acids unsaturated	84776-33-0			IN	Soap				
fenitrothion	122-14-5	204-524-2	35	IN	Organophosphorus		Notified		
fenoxycarb	72490-01-8	276-696-7	425	IN	Other Carbamate		Notified		
fenthion	55-38-9	200-231-9	79	IN	Organophosphorus		pending		
fipronil	120068-37-3		581	IN	Unclassified		Notified		
flucycloxuron	113036-88-7		473	IN	Benzoylurea		Out 7/03		
furathiocarb	65907-30-4	265-974-3	434	IN	Thiocarbamate		Out 7/03		
heptenophos	23560-59-0	245-737-0	527	IN	Organophosphorus		Out 7/03		
hexaflumuron	86479-06-3		8176	IN	Benzoylurea		Notified		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
imidacloprid	108527-78-9			IN	Chloro-nicotinyl				
isofenphos	25311-71-1	246-814-1	412	IN	Organophosphorus		Out 7/03		
lufenuron	103055-07-8	410-690-9	8203	IN	Benzoylurea		Notified		
methamidophos	10265-92-6	233-606-0	355	IN	Organophosphorus		pending		Y
methidathion	950-37-8	213-449-4	193	IN	Organophosphorus		out		
methomyl	16752-77-5	240-815-0	264	IN	N-Methyl Carbamate		Notified		
novaluron	116714-46-6			IN	Benzoylurea				
oleate potassium	143-18-0			IN	Soap				
parathion-methyl	298-00-0	206-050-1	487	IN	Organophosphorus		out		Y
piperonyl butoxide	51-03-6		33	IN	Unclassified		Not a PPP		
pirimicarb	23103-98-2	245-430-1	231	IN	N-Methyl Carbamate		Notified		
propoxur	114-26-1	204-043-8	80	IN	N-Methyl Carbamate		Out 7/03		
pyrethrins	8003-34-7	232-319-8	32	IN	Botanical				
pyridaphenthion	119-12-0		8269	IN	Organophosphorus		Out 7/03		
pyriproxyfen	95737-68-1		8271	IN	Unclassified		Notified		
soaps	-			IN	Soap				
tebufenozide	112410-23-8	412-850-3	8319	IN	Diacylhydrazine		Notified		
teflubenzuron	83121-18-0		450	IN	Benzoylurea		Notified		
tefluthrin	79538-32-2		451	IN	Pyrethroid		Notified		
thiacloprid	111988-49-9			IN	Chloro-nicotinyl		new ai; dossier submitted		
thiamethoxam	153719-23-4			IN	Unclassified		new ai; dossier submitted		
thiodicarb	59669-26-0		543	IN	Thiocarbamate		Notified		
triazamate	112143-82-5		8336	IN	Unclassified		Notified		
trichlorfon	52-68-6	200-149-3	68	IN	Organophosphorus		Notified		

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
bifenthrin	82657-04-3		415	IN, AC	Pyrethroid		Notified		
fenpropathrin	39515-41-8	254-485-0	426	IN, AC	Pyrethroid		Out 7/03		
carbofuran	1563-66-2	216-353-0	276	IN, NE	N-Methyl Carbamate		Notified		
oxydemeton-methyl	301-12-2	206-110-7	171	IN, NE	Organophosphorus		Notified		
phosphine	7803-51-2			IN,RO	Inorganic				
metaldehyde	9002-91-9			MO	Unclassified				
potassium chloride	7447-40-7			MO	Inorganic				
potassium sulfate	7778-80-5			MO	Inorganic				
metam-sodium	6734-80-1		20	NE, FU, BA, HB	Dithiocarbamate	RUP	Notified		
oxamyl	23135-22-0	245-445-3	342	NE, IN	N-Methyl Carbamate		Notified		
dichlormid	37764-25-3			not spec.	Unclassified		Not a PPP		
dithiocarbamates	-			not spec.	Dithiocarbamate	RUP			
fenchlorazole	103112-35-2			not spec.	Unclassified		Not a PPP		
flurazole	72850-64-7	276-942-3		not spec.	Unclassified		Not a PPP		
glue, entomological	-			not spec.	Unclassified				
herbs extract	-			not spec.	Botanical				
mefenpyr-diethyl	135590-91-9			not spec.	Unclassified				
polymere synthetic	-			not spec.	Unclassified				
sex attractans	-			not spec.	Unclassified				
waxes	-			not spec.	Unclassified				
codlemone	33956-49-9			not spec., IN	Pheromone				
1-naphthaleneacetamide	86-86-2		282	PG	Botanical				
1-naphthaleneacetic acid	86-87-3		313	PG	Naphthalene acetic acid derivative				
2-naphthyloxyacetic acid	120-23-0		664	PG	Naphthalene acetic acid derivative				

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
4-indol-3-ylbutyric acid	133-32-4		8187	PG	Unclassified				
6-benzylaminopurine	-			PG	Unclassified				
acibenzolar-S-methyl	135158-54-2	420-050-0		PG	Unclassified				
benzyladenine	1214-39-7		8029	PG	Unclassified				
chlormequat chloride	999-81-5	213-666-4	143	PG	Quaternary Ammonium Compound		Notified		
choline chloride	67-48-1		8064	PG	Unclassified				
cytokinins	-			PG	Unclassified				
daminozide	1596-84-5	216-485-9	330	PG	Unclassified		pending		
dimethipin	55290-64-7		8114	PG	Unclassified		Notified		
ethephon	16672-87-0	240-718-3	373	PG	Organophosphorus		Notified		
ethylenediaminetetra acetic acid	-			PG	Unclassified				
flurprimidol	56425-91-3			PG	Pyrimidine		Notified		
gibberellic acid	6550-86-3			PG	Botanical				
indolylacetic acid	87-51-4			PG	Botanical				
maleic hydrazide	123-33-1		310	PG	Unclassified		pending		
prohexadione – calcium	127277-53-6			PG	Unclassified		Annex I		
Sodium 5-nitroguayacolate	67233-85-6		8303	PG	Botanical		Notified		
Sodium o-Nitrophenolate	824-39-5		8304	PG	Botanical		Notified		
Sodium p-Nitrophenolate	824-78-2		8305	PG	Botanical		Notified		
trinexapac-ethyl	95266-40-3		8349	PG	Unclassified		Notified		
chlorpropham	101-21-3		43	PG, HB	Other Carbamate		pending		
chlorophacinone	3691-35-8	223-003-0	208	RD	1,3-Indandione				
2-hydroxyethylbutyl sulfide	-			RE	Unclassified				
3-methylbutiric acid	-			RE	Unclassified				
ammonia	1336-21-6	215-647-6	8013	RE	Inorganic				
aromatic composition	-			RE	Unclassified				

Chemical Identification						Regulatory Status			
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	PL	Directive 91/414	Water Directive	PIC
asphalts	-			RE	Unclassified				
carboxylic acids aliphatic	-			RE	Unclassified				
denatonium benzoate	3734-33-6		8096	RE	Unclassified				
fats natural	-			RE	Unclassified				
isovaleric acid	-			RE	Unclassified				
polyvinyl acetate	-			RE	Unclassified				
siliceous sand	-			RE	Unclassified				
taste composition	-			RE	Unclassified				
thioethylalcohol	-			RE	Unclassified				
valeric acid	109-52-4	203-677-2		RE	Unclassified				
thiram	137-26-8	205-286-2	24	RE, FU	Dithiocarbamate	RUP	pending		
methiocarb	2032-65-7	217-991-2	165	RE, MO	N-Methyl Carbamate		Notified		
brodifacoum	56073-10-0	259-980-5	370	RO	Coumarin				
carbon monoxide	630-08-0	211-128-3		RO	Unclassified				
sulfur dioxide	7446-09-5			RO	Inorganic				

Appendix 2 - Human Toxicology of Pesticides Authorized in Poland

Appendix 2 presents the human toxicity of the Pesticides Authorized in Poland 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 health related 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: 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: 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: 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 The mode(s) of carcinogenic action and associated key events have been identified in animals, and 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. 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. 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. 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. 2. Substances known to cause developmental toxicity in humans.
Category 2	1. Substances known to impair fertility in humans. 2. Substances known to cause developmental toxicity in humans.
Category 3	1. Substances which cause concern for human fertility. 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	
azocyclotin	41083-11-8	AC	II	T+	25-26-37/38-41-50/53							0,001
bromopropylate	18181-80-1	AC	U									0,03
clofentezine	74115-24-5	AC	U					C				0,02
cyhexatin	13121-70-5	AC	III	Xn	20/21/22-50/53			Not likely				0,007
fenazaquin	120928-09-8	AC	II	T	20-25-50/53							
fenbutatin oxide	13356-08-6	AC	U	T+	26-36/38-50/53			E				0,03
fenpyroximate	111812-58-9	AC										0,01
hexythiazox	78587-05-0	AC	U		50/53			C				0,03
propargite	2312-35-8	AC	III	Xn	22-36-50/53			B2				0,01
tebufenpyrad	119168-77-3	AC	III									
tetradifon	116-29-0	AC	U									
dinocap	39300-45-3	AC, FU	III	Xn	22-38			E				0,008
acrinathrin	101007-06-1	AC, IN	U					D				
amitraz	33089-61-1	AC, IN	III	Xn	22			C				0,01
dichlorvos	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
flufenoxuron	101463-69-8	AC, IN	U									
lambda-cyhalothrin	91465-08-6	AC, IN		T+	21-25-26-50/53							
malathion	121-75-5	AC, IN	III	Xn	22		3	D			Yes	0,3

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
aldicarb	116-06-3	AC, IN, NE	Ia	T+	24-26/28-50/53		3	E			Yes	0,003
phosalone	2310-17-0	AC,IN	II	T	21-25-50/53						Yes	0,02
pirimiphos-methyl	29232-93-7	AC,IN	III	Xn	22			Can not be determined			Yes	0,03
pyridaben	96489-71-3	AC,IN	III	T	23/25-50/53			E				
vamidothion	2275-23-2	AC,IN	Ib	T	21-25-50						Yes	
petroleum oils	68815-10-1	AD,IN, AC										
formaldehyde	50-00-0	BA		T	23/24/25-34-40-43	3	2A	B1				
streptomycin	57-92-1	BA										0,03
bradophen	-	BA, FU										
copper hydroxide	20427-59-2	BA, FU	III									
copper oxychloride	1332-40-7	BA, FU	III									
dimethylbenzoylammonium chloride	5538-94-3	BA, FU										
ethanoltriazine	-	BA, FU										
didecyldimethylammonium chloride	7173-51-5	BA, FU, HB			22-34			E				
glutaric aldehyde	111-30-8	BA, FU, HB		T	23/25-34-42/43-50							

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				
glyoxal	107-22-2	BA, FU, HB		Xn	20-36/38-68-43							
2-mercaptobenzothia-zolate-sodium	149-30-4	FU		Xi	43-50/53			C				
azaconazole	60207-31-0	FU	II	Xn	22-44							
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
bromuconazole	116255-48-2	FU	II					E				
bupirimate	41483-43-6	FU	U									
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									
chlorothalonil	1897-45-6	FU	U	Xn	40-50/53	3	2B	Likely				0,03
copper sulfate tribasic	-	FU										
cumylphenylate	-	FU										
cymoxanil	57966-95-7	FU	III	Xn	22-43-50/53			Not Likely				
cyproconazole	94361-06-5	FU	III	Xn	22-50/53-63			B2		3		
cyprodinil	121552-61-2	FU										
dichlofluanid	1085-98-9	FU	U	Xn	20-36-43-50/53							0,3

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	
difenoconazole	119446-68-3	FU	III					C				
dimethomorph	110488-70-5	FU	U		51/53							
diniconazole-M	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		
ethirimol	23947-60-6	FU	U	Xn	21							
famoxadone	131807-57-3	FU	U									
fenamidone	161326-34-7	FU										
fenarimol	60168-88-9	FU	U	Xn	51/53-62-63-64			E		3		0,01
fenhexamid	126833-17-8	FU	U									
fenpropimorph	67306-03-0	FU										0,003
fentin	76-87-9	FU	II	T+	24/25-26-37/38-40-41-48/23-50/53-63	3		B2		3		0,0005
fluazinam	79622-59-6	FU										
fludioxonil	131341-86-1	FU										
fluquinconazole	136426-54-5	FU		T	21-23/25-38-48/25-50/53							
flusilazole	85509-19-9	FU	III	T	61-22-40-51/53	3		Defered		2		0,001
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				
fuberidazole	3878-19-1	FU	II	Xn	22-50/53							
furalaxyl	57646-30-7	FU	III	Xn	22-52/53							
guazatine acetate	115044-19-4	FU										
hymexazol	10004-44-1	FU	U	Xn	22-41-52/53							
imazalil	35554-44-0	FU	II	Xn	20/22-41-50/53			C				0,03
iprodione	36734-19-7	FU	U	Xn	40-50/53	3		Likely				0,06
iprovalicarb	140923-17-7	FU	U									
isobutyric acid	79-31-2	FU		Xn	21/22							
kresoxim-methyl	143390-89-0	FU		Xn	40-50/53	3		Likely				
mancozeb	8018-01-7	FU	U	Xi	37-43			B2				0,03
maneb	12427-38-2	FU	U	Xi	37-43		3	B2				0,03
metalaxyl	57837-19-1	FU	III					E				0,03
metalaxyl-M	70630-17-0	FU		Xn	22-41							
metconazole	125116-23-6	FU	III									
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									

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	
oxadixyl	77732-09-3	FU	III					C				
oxine-salicilic copper	10380-28-6	FU	U				3					
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 hydro-chloride	25606-41-1	FU						D				
propiconazole	60207-90-1	FU	II					C				0,04
propineb	12071-83-9	FU	U									0,007
pyrimethanil	53112-28-0	FU	U					C				
quinoxyfen	124495-18-7	FU	U	Xi	43-50/53							
silthiopham	175217-20-6	FU										
spiroxamine	118134-30-8	FU	II	Xn	20/21/22-38-43-50/53							
tebuconazole	107534-96-3	FU	III					C				0,03
tetraconazole	112281-77-3	FU	II	Xn	20/22-40-51/53	3		Likely				
thiabendazole	148-79-8	FU	U		50/53			Likely				0,1
thiophanate-methyl	23564-05-8	FU	U	Xn	20-43-50/53-68			Likely	3			0,02
tolclofos-methyl	57018-04-9	FU	U								Yes	0,07
tolyfluanid	731-27-1	FU	U	T	23-36/37/38-43-48/ 20-50/53							0,1
triadimefon	43121-43-3	FU	III	Xn	22-51/53			C				0,03

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	
triadimenol	55219-65-3	FU	III					C				0,05
tridemorph	24602-86-6	FU		T	61-20/22-38-50/53					2		
trifloxystrobin	141517-21-7	FU										
triflumizole	68694-11-1	FU						E				
triforine	37273-84-0	FU										0,02
triticonazole	131983-72-7	FU	U									
vinclozolin	50471-44-8	FU	U	T	60-61-40-43-51/53	3		C		2		0,01
zoxamide	156052-68-5	FU										
dazomet	533-74-4	FU, IN, NE, HB,	III	Xn	22-36-50/53			D				
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				
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										
asulam	3337-71-1	HB	U					C				
atrazine	1912-24-9	HB	U	Xn	43-48/22-50/53		3	C				0,0007

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				
benazolin	3813-05-6	HB	U	Xi	36/38-52/53							
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		
capric acid	334-48-5	HB										
carbetamide	16118-49-3	HB	U									
carfentrazone-ethyl	128639-02-1	HB			50/53							
chloridazon	1698-60-8	HB	U	Xi	43-50/53							
chlorotoluron	15545-48-9	HB	U									0,015
chlorsulfuron	64902-72-3	HB	U		50/53							
cinidon-ethyl	142891-20-1	HB										
clethodim	99129-21-2	HB										0,01
clomazone	81777-89-1	HB	II									
clopyralid	1702-17-6	HB		Xi	41-51/53							
cyanazine	21725-46-2	HB	II	Xn	22-50/53			C				
cycloate	1134-23-2	HB	III									
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	120-36-5	HB	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				
dichlorprop-P	15165-67-0	HB		Xn	22-38-41-43		2B					
diclofop-methyl	51338-27-3	HB		Xn	22-43-50/53			C				
diflufenican	83164-33-4	HB	U		52/53							
dimefuron	34205-21-5	HB	U									
dimethachlor	50563-36-5	HB	III	Xn	22-43-50/53							
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				
ethofumesate	26225-79-6	HB	U		51/53			D				
fenoxaprop-P-ethyl	71283-80-2	HB										
florasulam	145701-23-1	HB										
fluazifop-P-butyl	79241-46-6	HB		Xn	50/53-63					3		
flufenacet	142549-58-3	HB										
Fluorochloridone	61213-25-0	HB	U									
fluoroglycofen-ethyl	77501-90-7	HB										
flupyrsulfuron-methyl sodium	144740-54-5	HB	U		50/53							
fluroxypyr	69377-81-7	HB	U		52/53			Not Likely				
flurtamone	96525-23-4	HB			50/53							

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				
glufosinate-ammonium	77182-82-2	HB		Xn	22							
glyphosate	1071-83-6	HB	U	Xi	41-51/53			E				0,3
haloxyfop-R	72619-32-0	HB		Xn	22-50/53							
imazamethabenz-methyl	81405-85-8	HB	U					D				
imazamox	11431-32-9	HB						Not Likely				
imazapyr	81334-34-1	HB	U	Xi	36-52/53			E				
imazethapyr	81335-77-5	HB	U									
iodosulfuron methyl-sodium	144550-36-7	HB										
isoproturon	34123-59-6	HB	III	Xn	22-40-50/53	3						
isoxaflutole	14112-29-0	HB						Likely				
lauric acid	143-07-7	HB										
lenacil	2164-08-1	HB	II									
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					
MCPB	94-81-5	HB	III	Xn	22		2B					
mecoprop	93-65-2	HB										
mecoprop-P	16484-77-8	HB	III				2B					
metamitron	41394-05-2	HB	III	Xn	22-50/53							

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				
metazachlor	67129-08-2	HB	U									
metobromuron	3060-89-7	HB	U									
metolachlor	51218-45-2	HB	III					C				0,0015
metosulam	139528-85-1	HB	U									
metribuzin	21087-64-9	HB	II	Xn	22-50/53			D				
napropamide	15299-99-7	HB	U									
naptalam	132-66-1	HB	U					D				
nicosulfuron	111991-09-4	HB	U					E				
oxadiargyl	39807-15-3	HB										
oxyfluorfen	42874-03-3	HB	U					C				
paraquat dichloride	1910-42-5	HB	II	T+	24/25-26-36/37/38-48/25-50/53			E				
pendimethalin	40487-42-1	HB	III	Xi	43-50/53			C				0,005
phenmedipham	13684-63-4	HB	U					D				
prometryn	7287-19-6	HB	U					E				
propachlor	1918-16-7	HB	III	Xn	22-36-43-50/53			Likely				
propaquizafop	111479-05-1	HB	U									
propisochlor	86763-47-5	HB										
propoxycarbazone-sodium	nocas 1466	HB										
propyzamide	23950-58-5	HB	U	Xn	40-50/53	3		B2				

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	
pyridate	55512-33-9	HB	III	Xi	38-43-50/53							
quinmerac	90717-03-6	HB	U									
quinoclamine	2797-51-5	HB	III									
quizalofop-P-ethyl	100646-51-3	HB										
quizalofop-P-tefuryl	119738-06-6	HB	II	T	61-22-48/22-62-68-50/53				3	3; 2		
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				
sulcotrione	99105-77-8	HB										
sulfosulfuron	141776-32-1	HB						Likely				
terbacil	5902-51-2	HB	U					E				
terbuthylazine	5915-41-3	HB	U					D				
terbutryn	886-50-0	HB	U					C				
thifensulfuron-methyl	79277-27-3	HB	U									
tralkoxydim	87820-88-0	HB	III					Likely				
tri-allate	2303-17-5	HB	III	Xn	22-43-48/22-50/53			C				
triasulfuron	82097-50-5	HB	U		50/53			E				
tribenuron methyl	101200-48-0	HB		Xi	43			C				

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	
triclopyr	55335-06-3	HB	III					D				
trifluralin	1582-09-8	HB	U	Xi	36-43-50/53		3	C				0,048
triflusulfuron-methyl	126535-15-7	HB	U					C				
methyl bromide	74-83-9	HB,AC, IN,NE, FU,RO		T	23/25-36/37/38-68-48/20-50-59		3	D				1
acephate	30560-19-1	IN	III	Xn	22			C			Yes	0,03
acetamiprid	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
benfuracarb	82560-54-1	IN	II	T	23/25-50/53						Yes	
bensultap	17606-31-4	IN	III	Xn	22-50/53							
beta-cyfluthrin	68359-37-5	IN	II	T+	23-28-50/53							0,02
buprofezin	69327-76-0	IN	U					Sugges-tive evi-dence				0,01
carbosulfan	55285-14-8	IN	II	T	23/25-43-50/53						Yes	0,01
chlorfenvinphos	470-90-6	IN	Ib	T+	24-28-50/53						Yes	0,0005
chloropicrin	76-06-2	IN		T+	22-26-36/37/38							
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

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	
cyfluthrin	68359-37-5	IN	II	T+	23-28-50/53							0,02
cypermethrin, zeta	52315-07-8	IN	Ib					C				0,05
cyromazine	66215-27-8	IN	U					E				0,02
deltamethrin	52918-63-5	IN	II	T	23/25-50/53		3					0,01
diazinon	333-41-5	IN	II	Xn	22-50/53			Not Likely			Yes	0,002
diflubenzuron	35367-38-5	IN	U					E				0,02
dimethoate	60-51-5	IN	II	Xn	21/22			C			Yes	0,002
esfenvalerate	66230-04-4	IN	II	T	23/25-43-50/53			E				
ethofenprox	80844-07-1	IN	U					C				0,03
fenitrothion	122-14-5	IN	II	Xn	22-50/53			E			Yes	0,005
fenoxycarb	72490-01-8	IN	U		50/53			B2				
fenthion	55-38-9	IN	II	T	21/22-23-68-48/25-50/53			E		3	Yes	0,007
fipronil	120068-37-3	IN	II					C				0,0002
flucycloxuron	113036-88-7	IN	U									
furathiocarb	65907-30-4	IN	Ib	T+	25-26-36/38-43-48/22-50/53							
heptenophos	23560-59-0	IN	Ib	T	25						Yes	
hexaflumuron	86479-06-3	IN	U									
imidacloprid	108527-78-9	IN										0,06
isofenphos	25311-71-1	IN	Ib	T	24/25			Not Likely			Yes	0,001

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	
lufenuron	103055-07-8	IN		Xi	43-50/53							
methamidophos	10265-92-6	IN	Ib	T+	24-28-36-50			E			Yes	0,004
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
novaluron	116714-46-6	IN										
oleate potassium	143-18-0	IN										
parathion-methyl	298-00-0	IN	Ia	T+	24-28		3	Not Likely			Yes	0,003
piperonyl butoxide	51-03-6	IN	U				3	C				0,02
pirimicarb	23103-98-2	IN	II	T	25-50/53						Yes	0,02
propoxur	114-26-1	IN	II	T	25-50/53			B2			Yes	0,02
pyridaphenthion	119-12-0	IN	III								Yes	
pyriproxyfen	95737-68-1	IN	U					E				
tebufenozide	112410-23-8	IN			51/53			E				
teflubenzuron	83121-18-0	IN	U									0,01
tefluthrin	79538-32-2	IN	Ib									
thiacloprid	111988-49-9	IN	II									
thiamethoxam	153719-23-4	IN						Likely				
thiodicarb	59669-26-0	IN	II					B2				0,03
triazamate	112143-82-5	IN	II									

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	
trichlorfon	52-68-6	IN	II	Xn	22-43		3	Not likely (low doses); likely (high doses)			Yes	0,02
bifenthrin	82657-04-3	IN, AC	II					C				0,02
fenpropathrin	39515-41-8	IN, AC		T+	21-25-26-50/53			E				0,03
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
metaldehyde	9002-91-9	MO										
metam-sodium	6734-80-1	NE, FU, BA, HB						B2				
oxamyl	23135-22-0	NE, IN	Ib	T+	21-26/28-51/53			Not Likely			Yes	0,03
dichlormid	37764-25-3	not spec.	III									
dithiocarbamates	nocas	not spec.										
fenchlorazole	103112-35-2	not spec.	U									
flurazole	72850-64-7	not spec.			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	
mefenpyr-diethyl	135590-91-9	not spec.						Not likely to be a human carcino-gen				
polymere synthetic	-	not spec.										
codlemone	33956-49-9	not spec., IN										
1-naphthaleneacetic acid	86-87-3	PG	U									
2-naphthyloxyacetic acid	120-23-0	PG	III									
4-indol-3-ylbutyric acid	133-32-4	PG										
6-benzylaminopurine	-	PG										
acibenzolar-S-methyl	135158-54-2	PG		Xi	36/37/38-43-50/53			Not likely				
benzyladenine	1214-39-7	PG										
chlormequat chloride	999-81-5	PG	III	Xn	21/22							0,05
cytokinins	-	PG										
daminozide	1596-84-5	PG	U	Xn	40	3		B2				0,5
dimethipin	55290-64-7	PG	III					C				0,02

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				
ethephon	16672-87-0	PG	U		20/21-34-52/53			D			Yes	0,05
ethylenediaminetetra acetic acid	-	PG										
flurprimidol	56425-91-3	PG	III									
maleic hydrazide	123-33-1	PG	U				3					5
prohexadione – calcium	127277-53-6	PG										
trinexapac-ethyl	95266-40-3	PG										
chlorpropham	101-21-3	PG, HB	U				3	E				0,03
choline chloride	67-48-1	PGR										
chlorophacinone	3691-35-8	RD	Ia	T+	23-27/28-48/24/25-50/53							
thiram	137-26-8	RE, FU	III	Xn	20/22-36/37-68-43		3			3		0,01
methiocarb	2032-65-7	RE, MO	Ib	T	25-50/53			D			Yes	0,02
brodifacoum	56073-10-0	RO	Ia	T+	27/28-48/24/25-50/53							
carbon monoxide	630-08-0	RO		T	61-12-23-48/23							

Appendix 3 - Ingredients Authorized in Poland 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. Additionally category 3 distinguishes 3 subcategories: A(w,m) - no data available on wildlife relevant and/or mammal relevant endocrine effects; B - some data are available but the evidence is insufficient for identification. 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 *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**
clofentezine	AC	Thyroid				x		Not	
acrinathrin	AC, IN								
amitraz	AC, IN					x		Not	
dichlorvos	AC, IN					x		Not	
endosulfan	AC, IN	Estrogen	Y	K	Y	x	2	Pers+	
Karate (lambda-cyhalothrin)	AC, IN	Thyroid				x		Not	
malathion	AC, IN	Thyroid		S	Y	x	2	Not	
aldicarb	AC, IN, NE		Y	S	Y	x		Not	
copper oxychloride	BA, FU					x	3 C	metal	
benomyl	FU		Y	P	Y	x		Not	
carbendazim	FU					x	2	Not	
difenoconazole	FU					x		Pers	
fenarimol	FU	Estrogen				x		Pers	
fentin	FU		Y						
flutriafol	FU					x		Pers	
iprodione	FU	Inhibition of testosterone synthesis				x	2	Not	
mancozeb	FU	Thyroid	Y	P	Y				
maneb	FU	Thyroid		P	Y	x	1	Not	High
metiram	FU			P	Y	x		Not	
myclobutanil	FU					x		Not	

						European Union			
Chemical	Use Type	Colborn	Benbrook	EPA Illinois	Keith	EU Review.	EU ED Cat.	Persist.	Exposure Concern
prochloraz	FU					x	2	Not	
procymidone	FU	Andro-gen				x		Pers	
propiconazole	FU					x		Pers	
pyrimethanil	FU	Thyroid							
tebuconazole	FU					x		Not	
triadimefon	FU	Estrogen				x	2	Not	
triadimenol	FU	Estrogen							
vinclozolin	FU	Andro-gen	Y	P	Y	x	1	Pers	High
2,4-D	HB		Y	P	Y	x	2	Not	
acetochlor	HB	Thyroid				x	1	Not	High
alachlor	HB	Thyroid	Y	P	Y	x	1	Not	High
atrazine	HB	Neuroen-docrine-pituitary	Y	K	Y	x	1	Pers	High
bromoxynil	HB					x		Not	
cyanazine	HB		Y			x		Not	
diuron	HB					x	2	Not	
linuron	HB	Andro-gen				x	1	Not	High
metolachlor	HB				Y				
metribuzin	HB	Thyroid	Y	S	Y	x		Not	
pendimethalin	HB	Thyroid				x		Pers	
prometryn	HB					x		Not	
propyzamide	HB					x		Not	
s-metolachlor	HB				Y				
simazine	HB				Y	x	2	Not	
terbutryn	HB					x		Pers	
trifluralin	HB	Repro-ductive/ Meta-bolic	Y	P	Y	x		Pers	
methyl bromide	HB,AC,IN ,NE,FU,R O					x	2	Not	
acephate	IN					x		Not	
alpha-cypermethrin	IN								
beta-cyfluthrin	IN								
chlorfenvinphos	IN					x		Not	
chlorpyrifos	IN		Y		Y	x		Not	

						European Union			
Chemical	**Use Type**	**Colborn**	**Benbrook**	**EPA Illinois**	**Keith**	**EU Review.**	**EU ED Cat.**	**Persist.**	**Exposure Concern**
cyfluthrin	IN								
cypermethrin, zeta	IN	Disruption of reproductive function	Y	S	Y	x		Not	
deltamethrin	IN					x		Not	
diazinon	IN					x	2	Not	
diflubenzuron	IN					x		Pers	
dimethoate	IN					x	2	Not	
esfenvalerate	IN			S		x		Not	
ethofenprox	IN					x		Not	
fenitrothion	IN	Antiandrogen				x		Not	
fenoxycarb	IN					x		Not	
fenthion	IN					x	3 C*	Not	
fipronil	IN	Thyroid							
methomyl	IN	Thyroid	Y	S	Y	x		Not	
parathion-methyl	IN		Y	P		x	2	Not	
piperonyl butoxide	IN					x		Not	
tefluthrin	IN								
trichlorfon	IN					x		Not	
bifenthrin	IN, AC					x		Pers	
fenpropathrin	IN, AC								
carbofuran	IN, NE					x		Not	
oxydemeton-methyl	IN, NE					x		Not	
thiram	RE, FU	Neuroendocrine-pituitary				x	1	Not	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 Poland

Appendix 4 presents the environmental toxicity of the pesticides authorized in Poland 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
azocyclotin	41083-11-8	AC	N	50/53							
bromopropylate	18181-80-1	AC									
clofentezine	74115-24-5	AC			4	16,1	9	9	52,8	1	86,9
cyhexatin	13121-70-5	AC	N	50/53	6,2	3,2	18,8	5,7	27,2	2	55
fenazaquin	120928-09-8	AC	N	50/53							
fenbutatin oxide	13356-08-6	AC	N	50/53	3,7	3,2	5	3	17,6	2	28,8
fenpyroximate	111812-58-9	AC									
hexythiazox	78587-05-0	AC	N	50/53	6	25	9	9	52,8	1	95,8
propargite	2312-35-8	AC	N	50/53	6	25	9	9	39,2	1	82,2
tebufenpyrad	119168-77-3	AC									
tetradifon	116-29-0	AC									
dinocap	39300-45-3	AC, FU			12	15	3	3	15,9	1	36,9
acrinathrin	101007-06-1	AC, IN									
amitraz	33089-61-1	AC, IN			6,5	3	9	3	18,2	3	33,2
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
flufenoxuron	101463-69-8	AC, IN									
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
aldicarb	116-06-3	AC, IN, NE	N	50/53	14	3	30	3	16,4	5	52,4

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
phosalone	2310-17-0	AC,IN	N	50/53	3,6	16,1	3	3	17,4	2	39,5
pirimiphos-methyl	29232-93-7	AC,IN									
pyridaben	96489-71-3	AC,IN	N	50/53	3,1	16,1	6,2	46,5	54,6	1	123,3
vamidothion	2275-23-2	AC,IN	N	50							
petroleum oils	68815-10-1	AD,IN,AC									
formaldehyde	50-00-0	BA									
streptomycin	57-92-1	BA			4,6	13,7	4,5	3	12,4	1,6	33,5
bradophen	-	BA, FU									
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									
dimethylbenzoylammonium chloride	5538-94-3	BA, FU									
ethanoltriazine	-	BA, FU									
didecyldimethylammonium chloride	7173-51-5	BA, FU, HB									
glutaric aldehyde	111-30-8	BA, FU, HB	N	50							
glyoxal	107-22-2	BA, FU, HB									
2-mercaptobenzothiazolate-sodium	149-30-4	FU	N	50/53							
azaconazole	60207-31-0	FU									
azoxystrobin	131860-33-8	FU	N	50/53	5	15	6	3	12,6	3	36,6

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
benalaxyl	71626-11-4	FU									
benomyl	17804-35-2	FU			50	25	15	15	73,5	5	128,5
bitertanol	55179-31-2	FU									
bromuconazole	116255-48-2	FU									
bupirimate	41483-43-6	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
chlorothalonil	1897-45-6	FU	N	50/53	11	25	12	15	50	1	102
copper sulfate tribasic	-	FU									
cumylphenylate	-	FU									
cymoxanil	57966-95-7	FU	N	50/53	5,5	3	3	3	12,4	3	21,4
cyproconazole	94361-06-5	FU	N	50/53							
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-M	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							
ethirimol	23947-60-6	FU									

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
famoxadone	131807-57-3	FU									
fenamidone	161326-34-7	FU									
fenarimol	60168-88-9	FU	N	51/53	23	25	9	3	10	5	47
fenhexamid	126833-17-8	FU									
fenpropimorph	67306-03-0	FU									
fentin	76-87-9	FU	N	50/53	5	18	12	9	30	1	69
fluazinam	79622-59-6	FU									
fludioxonil	131341-86-1	FU									
fluquinconazole	136426-54-5	FU	N	50/53							
flusilazole	85509-19-9	FU	N	51/53	9	18	39,8	9	15	1	81,8
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
fuberidazole	3878-19-1	FU	N	50/53							
furalaxyl	57646-30-7	FU		52/53							
guazatine acetate	115044-19-4	FU									
hymexazol	10004-44-1	FU		52/53							
imazalil	35554-44-0	FU	N	50/53	3,9	13,8	1,5	3,3	14,3	1,6	32,9
iprodione	36734-19-7	FU	N	50/53	3,1	15	6,2	9,3	38,3	1	68,7
iprovalicarb	140923-17-7	FU									
isobutyric acid	79-31-2	FU									
kresoxim-methyl	143390-89-0	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
mancozeb	8018-01-7	FU			17	25	12	15	78	1	130
maneb	12427-38-2	FU			17	25	12	15	83,3	1	135,3
metalaxyl	57837-19-1	FU			11	1	6	9	52,5	5	68,5
metalaxyl-M	70630-17-0	FU									
metconazole	125116-23-6	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									
oxadixyl	77732-09-3	FU									
oxine-salicilic copper	10380-28-6	FU									
pencycuron	66063-05-6	FU									
prochloraz	67747-09-5	FU	N	50/53							
procymidone	32809-16-8	FU									
propamocarb hydro-chloride	25606-41-1	FU									
propiconazole	60207-90-1	FU			14,6	3	9,1	9,1	30,6	1	51,7
propineb	12071-83-9	FU									
pyrimethanil	53112-28-0	FU									
quinoxyfen	124495-18-7	FU	N	50/53							
silthiopham	175217-20-6	FU									
spiroxamine	118134-30-8	FU	N	50/53							
tebuconazole	107534-96-3	FU									

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
tetraconazole	112281-77-3	FU	N	51/53							
thiabendazole	148-79-8	FU	N	50/53							
thiophanate-methyl	23564-05-8	FU	N	50/53	28	9	9	15	63,5	1	96,5
tolclofos-methyl	57018-04-9	FU									
tolyfluanid	731-27-1	FU	N	50/53							
triadimefon	43121-43-3	FU	N	51/53	10	9	9	9	35	3	62
triadimenol	55219-65-3	FU									
tridemorph	24602-86-6	FU	N	50/53							
trifloxystrobin	141517-21-7	FU									
triflumizole	68694-11-1	FU			7,8	5	8,1	9,3	38,3	1	60,7
triforine	37273-84-0	FU									
triticonazole	131983-72-7	FU									
vinclozolin	50471-44-8	FU	N	51/53	7,2	5	9,2	9,3	33,2	1	56,7
zoxamide	156052-68-5	FU									
dazomet	533-74-4	FU, IN, NE, HB,	N	50/53							
2,4-D	94-75-7	HB		52/53	7	3	18	9	60	1	90
acetochlor	34256-82-1	HB	N	50/53							
alachlor	15972-60-8	HB	N	50/53	6	9	3	3	25	3	40
amidosulfuron	120923-37-7	HB									
asulam	3337-71-1	HB									
atrazine	1912-24-9	HB	N	50/53	9,5	9	9	9	51	5	78

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
benazolin	3813-05-6	HB		52/53							
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
capric acid	334-48-5	HB									
carbetamide	16118-49-3	HB									
carfentrazone-ethyl	128639-02-1	HB	N	50/53							
chloridazon	1698-60-8	HB	N	50/53	7	3	9	3	20	5	35
chlorotoluron	15545-48-9	HB									
chlorsulfuron	64902-72-3	HB	N	50/53							
cinidon-ethyl	142891-20-1	HB									
clethodim	99129-21-2	HB			4	6,4	3	3	17	3	29,3
clomazone	81777-89-1	HB			4	3	3	3	17	3	26
clopyralid	1702-17-6	HB	N	51/53							
cyanazine	21725-46-2	HB	N	50/53	7,3	3	3	3	17	3	26
cycloate	1134-23-2	HB			5	9	6	3	17	3	35
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
dichlorprop	120-36-5	HB			7,5	3	26,1	9	50,9	1	89
dichlorprop-P	15165-67-0	HB									
diclofop-methyl	51338-27-3	HB	N	50/53	3	9	6	9	36	1	60

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
diflufenican	83164-33-4	HB		52/53							
dimefuron	34205-21-5	HB									
dimethachlor	50563-36-5	HB	N	50/53							
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
ethofumesate	26225-79-6	HB	N	51/53							
fenoxaprop-P-ethyl	71283-80-2	HB									
florasulam	145701-23-1	HB									
fluazifop-P-butyl	79241-46-6	HB	N	50/53							
flufenacet	142549-58-3	HB									
Fluorochloridone	61213-25-0	HB									
fluoroglycofen-ethyl	77501-90-7	HB									
flupyrsulfuron-methyl sodium	144740-54-5	HB	N	50/53							
fluroxypyr	69377-81-7	HB		52/53							
flurtamone	96525-23-4	HB	N	50/53							
glufosinate-ammonium	77182-82-2	HB			7,3	3	4,7	6,4	35,9	5	50
glyphosate	1071-83-6	HB	N	51/53	7	15	9	9	41,3	1	74,3
haloxyfop-R	72619-32-0	HB	N	50/53							
imazamethabenz-methyl	81405-85-8	HB									
imazamox	11431-32-9	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
imazapyr	81334-34-1	HB		52/53	10	2,1	9	3	17	5	31,1
imazethapyr	81335-77-5	HB			7	1	6	9	50,9	5	66,9
iodosulfuron methyl-sodium	144550-36-7	HB									
isoproturon	34123-59-6	HB	N	50/53							
isoxaflutole	14112-29-0	HB									
lauric acid	143-07-7	HB									
lenacil	2164-08-1	HB									
linuron	330-55-2	HB	N	50/53	9	9	27	9	51	3	96
MCPA	94-74-6	HB									
MCPB	94-81-5	HB									
mecoprop	93-65-2	HB									
mecoprop-P	16484-77-8	HB			9,7	1	6	9	50,9	5	66,9
metamitron	41394-05-2	HB	N	50/53							
metazachlor	67129-08-2	HB									
metobromuron	3060-89-7	HB									
metolachlor	51218-45-2	HB			7	9	6	3	17	3	35
metosulam	139528-85-1	HB									
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
naptalam	132-66-1	HB			9,1	7,2	8,4	9	50,9	3,1	75,5
nicosulfuron	111991-09-4	HB			8	3,6	6	9	51	5	69,6

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
oxadiargyl	39807-15-3	HB									
oxyfluorfen	42874-03-3	HB			8,5	25	27	9	51	1	112
paraquat dichloride	1910-42-5	HB	N	50/53							
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
prometryn	7287-19-6	HB									
propachlor	1918-16-7	HB	N	50/53							
propaquizafop	111479-05-1	HB									
propisochlor	86763-47-5	HB									
propoxycarbazone-sodium	nocas 1466	HB									
propyzamide	23950-58-5	HB	N	50/53	10	5	9	9	51	1	74
pyridate	55512-33-9	HB	N	50/53	3	10,8	6	9	51	1	76,8
quinmerac	90717-03-6	HB									
quinoclamine	2797-51-5	HB									
quizalofop-P-ethyl	100646-51-3	HB									
quizalofop-P-tefuryl	119738-06-6	HB	N	50/53							
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
sulcotrione	99105-77-8	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
sulfosulfuron	141776-32-1	HB									
terbacil	5902-51-2	HB			11	3	9	3	12,5	5	27,5
terbuthylazine	5915-41-3	HB									
terbutryn	886-50-0	HB									
thifensulfuron-methyl	79277-27-3	HB			1,5	0	0	0	0	0	0
tralkoxydim	87820-88-0	HB									
tri-allate	2303-17-5	HB	N	50/53	4	15	6	3	17	1	41
triasulfuron	82097-50-5	HB	N	50/53							
tribenuron methyl	101200-48-0	HB									
triclopyr	55335-06-3	HB			9,5		9	9	51	5	72
trifluralin	1582-09-8	HB	N	50/53	8,5		9	3	20	1	57
triflusulfuron-methyl	126535-15-7	HB									
methyl bromide	74-83-9	HB,AC,IN, NE,FU,R O	N	50-59							
acephate	30560-19-1	IN			4	1	9	15	18,7	1	43,7
acetamiprid	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
benfuracarb	82560-54-1	IN	N	50/53							
bensultap	17606-31-4	IN	N	50/53							
beta-cyfluthrin	68359-37-5	IN	N	50/53	7	5	9	45	60	1	119

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
buprofezin	69327-76-0	IN									
carbosulfan	55285-14-8	IN	N	50/53							
chlorfenvinphos	470-90-6	IN	N	50/53	6,2	16,1	20,6	28,5	23	2	88,2
chloropicrin	76-06-2	IN			3,5	3,8	9,9	3,3	12,4	1	29,4
chlorpyrifos	2921-88-2	IN	N	50/53	8,5	25	45	15	19,9	1	104,9
chlorpyrifos-methyl	5598-13-0	IN									
cyfluthrin	68359-37-5	IN	N	50/53	7	5	9	45	60	1	119
cypermethrin, zeta	52315-07-8	IN									
cyromazine	66215-27-8	IN			8,5	3	10,4	17,2	33,6	5	64,2
deltamethrin	52918-63-5	IN	N	50/53	3	16,1	3	15	20,4	2	54,5
diazinon	333-41-5	IN	N	50/53	8	15	30	15	19,5	3	79,5
diflubenzuron	35367-38-5	IN			5,5	5	9	15	69	1	98
dimethoate	60-51-5	IN			9	5	30	45	60,9	3	140,9
esfenvalerate	66230-04-4	IN	N	50/53	4	25	9	45	57,8	1	136,8
ethofenprox	80844-07-1	IN									
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							
fenthion	55-38-9	IN	N	50/53							
fipronil	120068-37-3	IN			7,1	16,1	36,8	6,3	33,6	1	92,8
flucycloxuron	113036-88-7	IN									
furathiocarb	65907-30-4	IN	N	50/53							
heptenophos	23560-59-0	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
hexaflumuron	86479-06-3	IN									
imidacloprid	108527-78-9	IN									
isofenphos	25311-71-1	IN			6,9	9,7	37,2	19,1	34,3	2	100,3
lufenuron	103055-07-8	IN	N	50/53							
methamidophos	10265-92-6	IN	N	50	11	1	30	45	65,3	5	141,3
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
novaluron	116714-46-6	IN									
oleate potassium	143-18-0	IN									
parathion-methyl	298-00-0	IN			4	9	3	15	20,7	1	47,7
piperonyl butoxide	51-03-6	IN			3,7	3,2	9	3	13,5	2	28,7
pirimicarb	23103-98-2	IN	N	50/53	11,4	3,2	24,8	3	15	2	45,9
propoxur	114-26-1	IN	N	50/53	13	16	60	45	55,8	1	176,8
pyridaphenthion	119-12-0	IN									
pyriproxyfen	95737-68-1	IN									
tebufenozide	112410-23-8	IN	N	51/53	14	9	11	15	88	3	123
teflubenzuron	83121-18-0	IN									
tefluthrin	79538-32-2	IN			5,9	15	7,4	28,5	33,4	1	84,3
thiacloprid	111988-49-9	IN									
thiamethoxam	153719-23-4	IN									
thiodicarb	59669-26-0	IN			2,5	9	3	3	17,6	1	32,6
triazamate	112143-82-5	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
trichlorfon	52-68-6	IN			6,5	16,1	15	9	20,2	2	60,3
bifenthrin	82657-04-3	IN, AC			8,3	16	6,3	18,5	38,1	2	78,9
fenpropathrin	39515-41-8	IN, AC	N	50/53	5,1	16	9	45	55,5	2,1	125,5
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
metaldehyde	9002-91-9	MO									
metam-sodium	6734-80-1	NE, FU, BA, HB			5,8	3,6	8,4	9,1	38,2	1,6	59,3
oxamyl	23135-22-0	NE, IN	N	51/53	8,5	3	15	9	18,2	1	45,2
dichlormid	37764-25-3	not spec.									
fenchlorazole	103112-35-2	not spec.									
flurazole	72850-64-7	not spec.	N	51/53							
mefenpyr-diethyl	135590-91-9	not spec.									
polymere synthetic	-	not spec.									
codlemone	33956-49-9	not spec., IN									
1-naphthaleneacetic acid	86-87-3	PG									
2-naphthyloxyacetic acid	120-23-0	PG									
4-indol-3-ylbutyric acid	133-32-4	PG									
6-benzylaminopurine	-	PG									

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
acibenzolar-S-methyl	135158-54-2	PG	N	50/53							
benzyladenine	1214-39-7	PG									
chlormequat chloride	999-81-5	PG									
choline chloride	67-48-1	PG									
cytokinins	-	PG									
daminozide	1596-84-5	PG									
dimethipin	55290-64-7	PG									
ethephon	16672-87-0	PG		52/53							
ethylenediaminetetra acetic acid	-	PG									
flurprimidol	56425-91-3	PG									
maleic hydrazide	123-33-1	PG			7,6	3,4	6	9	50,9	3,1	69,3
prohexadione – calcium	127277-53-6	PG									
trinexapac-ethyl	95266-40-3	PG									
chlorpropham	101-21-3	PG, HB			5	15	6	3	17	1	41
chlorophacinone	3691-35-8	RD	N	50/53							
thiram	137-26-8	RE, FU			7,2	15	18,5	9,3	40,8	1	83,5
methiocarb	2032-65-7	RE, MO	N	50/53							
brodifacoum	56073-10-0	RO	N	50/53							
carbon monoxide	630-08-0	RO									

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			
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			
captan	133-06-2			apple, pear, cherries canned, strawberries, table wine, cauliflower, Chinese cabbage, lettuce	8
carbendazim	10605-21-7			apple, strawberries, cauliflower, celery root, cucumber, lettuce, linnen seed, frozen peas, potatoes, savoy	10
carbetamide	16118-49-3	x	x		
carbofuran	1563-66-2	x		strawberries	1
chlorfenvinphos	470-90-6	x		oats, carrots, celery root	3
chloridazon	1698-60-8	x	x		
chlorotoluron	15545-48-9	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
cyanazine	21725-46-2	x			
cyfluthrin	68359-37-5	x		zucchini	1
cypermethrin, zeta	52315-07-8	x		cherries canned, broccoli, celery root, Chinese cabbage, lettuce, savoy, zucchini	7
deltamethrin	52918-63-5	x		wheat, apple, table wine, frozen spinach	4
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	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.
dimefuron	34205-21-5	x	x		
dimethoate	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		
Dithiocarbamates (maneb, metiram, mancozeb, metam-sodium, propineb, thiram)				apple, pear, plum, cherries canned, strawberries, table wine, broccoli, carrots, cauliflower, celery root, Chinese cabbage, cucumber, kale, lettuce, linnen seed, onion, frozen peas, savoy, zucchini	19
endosulfan	115-29-7	x		apple, cherries canned, strawberries, broccoli, carrots, Chinese cabbage, linnen seed, onion, frozen peas, frozen spinach, zucchini	11
ethephon	16672-87-0	x			
ethephon	16672-87-0	x			
ethofumesate	26225-79-6	x			
ethofumesate	26225-79-6	x			
fenitrothion	122-14-5		x		
fenpropathrin	39515-41-8			cucumber,	1
fenpropathrin	39515-41-8			cucumber	1
fenthion	55-38-9	x		sweet cherries	1
fenthion	55-38-9	x		sweet cherries	1
Fluorochloridone	61213-25-0	x			
Fluorochloridone	61213-25-0	x			
fluroxypyr	69377-81-7	x			
fluroxypyr	69377-81-7	x			
folpet	133-07-3			cherries canned, broccoli, cauliflower, Chinese cabbage	4
folpet	133-07-3			cherries canned, broccoli, cauliflower, Chinese cabbage	4
glyphosate	1071-83-6		x		
glyphosate	1071-83-6		x		
haloxyfop-R	72619-32-0	x			
haloxyfop-R	72619-32-0	x			
imazalil	35554-44-0			cherries canned, cauliflower, cucumber	3
imazalil	35554-44-0			cherries canned, cauliflower, cucumber	3
iprodione	36734-19-7			wheat, cherries canned, strawberries, carrots, Chinese cabbage, cucumber, lettuce, linnen seed, frozen peas, potatoes, savoy, frozen spinach	12

Pesticide	CAS Number	Ground Water	Surface Water	Food/ Crop	Nr.
isofenphos	25311-71-1		x		
isoproturon	34123-59-6	x	x		
lambda-cyhalothrin	91465-08-6	x		cherries canned, frozen spinach	2
lenacil	2164-08-1		x		
linuron	330-55-2	x			
malathion	121-75-5			wheat, rye, oats, apple, linnen seed	5
MCPA	94-74-6	x	x		
MCPB	94-81-5	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		
methamidophos	10265-92-6			Chinese cabbage, lettuce	2
methidathion	950-37-8	x			
methyl bromide	74-83-9			wheat, rye, oats, broccoli, linnen seed	6
metobromuron	3060-89-7	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		
oxadixyl	77732-09-3	x	x	apple, frozen spinach	2
oxydemeton-methyl	301-12-2			cauliflower, zucchini	2
parathion-methyl	298-00-0	x	x	apple, carrots, celery root, mushroom cultivated (Agaricus), potatoes	7
pendimethalin	40487-42-1	x	x		
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	5
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
propyzamide	23950-58-5	x		strawberries, Chinese cabbage, potatoes, savoy, zucchini	5
quinmerac	90717-03-6		x		
simazine	122-34-9	x	x		
tebuconazole	107534-96-3		x		
terbuthylazine	5915-41-3	x	x		
terbutryn	886-50-0	x	x		

Pesticide	CAS Number	Ground Water	Surface Water	Food/ Crop	Nr.
thiabendazole	148-79-8			wheat, pear, strawberries, asparagus, carrots, cucumber, kale, potatoes, savoy	9
tolclofos-methyl	57018-04-9			asparagus, carrots, lettuce,	3
tolyfluanid	731-27-1			apple, strawberries, linnen seed, frozen peas	4
tri-allate	2303-17-5	x			
triadimefon	43121-43-3			celery root, savoy, frozen spinach	3
triadimenol	55219-65-3	x		rye, strawberries	2
triclopyr	55335-06-3	x			
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

Sources:

Bundesinstitut für gesundheitlichen Verbraucherschutz und Veterinärmedizin (BgVV) (2002): Lebensmittelmonitoring 1997 to 2000 (only foodstuffs with plant and German origin), submitted as table via mail, June 2002, Berlin, Germany

Ministerium für Raumordnung, Landwirtschaft und Umwelt des Landes Sachsen-Anhalt (2001): Pflanzenschutzmittel in Grund und Oberflächenwasser 1997-2000, submitted as table via mail in April 2001, Magdeburg, Germany

Freie und Hanse Stadt Hamburg Umweltbehörde (2001): Umwelt 4/2001, Hamburg, Germany

Freie und Hanse Stadt Hamburg Umweltbehörde (1999): PSM-Wirkstoffstatistik für die Jahre 1998, 1999, submitted as table via mail in May 2001, Hamburg, Germany

Landesamt für Umwelt und Geologie Sachsen (2001): Pflanzenschutzmittelfunde im Wasser 1997-1999, submitted as table via mail in April 2001, Dresden, Germany

Ministerium für Umwelt, Natur und Forsten des Landes Schleswig-Holstein (2001): Pflanzenschutzmittelfunde im Wasser 1997-1999, submitted as table via mail in Mai 2001, Kiel, Germany

Niedersächsisches Landesamt für Ökologie (1999): Grundwasserbericht 1997, Hildesheim, Germany

Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen (2001): Grundwasserbeschaffenheit - Pflanzenschutzmittel, submitted as table via mail in Mai 2001, Düsseldorf, Germany

Landesanstalt für Umweltschutz Baden-Württemberg (2000): Beschaffenheit der Fließgewässer, Jahresdatenkatalog 1998 (CD-ROM), Karlsruhe, Germany

Ministerium für Raumordnung, Landwirtschaft und Umwelt des Landes Sachsen-Anhalt (2001): Pflanzenschutzmittel in Grund- und Oberflächenwasser 1997-2000, submitted as table via mail in April 2001, Magdeburg, Germany

Landesamt für Umwelt und Geologie Sachsen (2001): Pflanzenschutzmittelfunde im Wasser 1997-1999, submitted as table via mail in April 2001, Dresden, Germany

Landesumweltamt Nordrhein-Westfalen (1999): Gewässergütebericht ‘97, Pflanzenbehandlungs- und Schädlingsbekämpfumgmittel in Oberflächengewässern (incl. CD-ROM based database), Essen, Germany

Ministerium für Umwelt, Natur und Forsten des Landes Schleswig-Holstein (2001): Herbizide und Pestizide, die in Schleswig-Holstein in den Jahren 1997 - 2000 nachgewiesen wurden (Fließgewässer), submitted as table via mail in Mai 2001, Kiel, Germany

Arbeitsgemeinschaft für die Reinhaltung der Elbe (1998): Wassergütedaten der Elbe 1998, downloadable: www.arge-elbe.de, Hamburg, Germany

Arbeitsgemeinschaft für die Reinhaltung der Weser (2001): Wassergütedaten 1997 -1999, downloadable: http://www.nloe.de/wgstw/index.html, Hildesheim, Germany

Ministerium für Landwirtschaft, Naturschutz und Umwelt (2000): Thüringer Umweltberichte, Erfurt, Germany

Freie und Hansestadt Hamburg Umweltbehörde (1999): Wassergütemessnetz Hamburg, Elbe und Nebengewässer, Jahresbericht 1998, Hamburg, Germany

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

Act of 12 July 1995 on protection of cultivated plants amended by Act of 16 February 2001 (Journal of Laws, No 22, 248)

Decree of the Ministry of Agriculture and Food Economy of 10 January 1991 (Journal of Laws No 14, 64) on safety and hygiene rules at applying and storing pesticides and mineral and artificial fertilisers in agriculture.

Decree of the Ministry of Agriculture and Food Economy of 12 March, 1996 concerning detailed principles of granting authorisation of plant protection products (plant protection products) to be placed on the market, amended by the Decree of 5 March, 2002 (Journal of Laws, No 24, 250).

Decree of the Minister of Health of 15 April 1997 concerning maximum residue limits for chemicals used in protection, transportation and storage of food and plants (Journal of Laws, No 43, 273). Amending of this Decree is in the final stage of legislative procedure.

Decree of the Minister of Agriculture and Rural Development of 11 February 1999 on detailed principles of the inspection of plant protection equipment (Journal of Laws, No 20, 175), amended by the Decree of 15 March 2001 (Journal of Laws, No 30, 349).

Decree of the Minister of Agriculture and Food Economy of 20 September, 2001 concerning detailed demands from a training unit (Journal of Laws No 114, 1222).

Decree of the Minister of Agriculture and Rural Development of 4 October 2001 on technical requirements for sprayers (Journal of Laws, No 121, 1303).

Decree of the Minister of Agriculture and Rural Development of 15 November 2001 on the inspection of sprayers (Journal of Laws, No 137, 1544).

Polish Standard of 19 April 1999. PN-C-04657 Plant Protection Products. Packing, Storage and Transport.

Handbook of Plant Protection. Principles of safety and efficacious use of methods and plant protection products. edited by the Plant Protection Institute, Poznan, 1994.