PAN Germany

Pesticides in Central and Eastern European Countries

Usage, Registration, Identification and Evaluation

Part 3: Czech Republic

Hamburg, 2003

Pesticide Action Network

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

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

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1 Introduction

Pesticide use in EU accession countries has been very low in the over the last decade, but it is on the rise again. The accession of the Czech Republic into the European Union will most likely lead to an intensification in agriculture. But 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 the Czech Republic.

PAN Germanys' Publications:

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

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

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

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

2 Goals

This study has got the following goals:

- to give an overview about agriculture and on pesticide use in the Czech Republic
- to characterise the pesticide active ingredients authorized in the Czech Republic
- 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 relevant 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.

Persons, 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 Introduction to the Czech Republic

The Czech Republic came into being on 1 January 1993. The country underwent a " velvet divorce" into its two national components, the Czech Republic and Slovakia. Now, being a member of NATO, the Czech Republic has moved toward integration in world markets and the European Union, a development that poses opportunities as well as challenges.

The Czech Republic is situated in the centre of Europe. It has a population of 10 million people and covers an area of about 80,000 km^2. The Czech Republic consists of three historic lands: Bohemia, Moravia and Silesia. A natural border between Moravia and Bohemia is set by the Bohemian-Moravian Highland. The biggest mountain in the Czech Republic is Snezka (1612m) in the Giant Mountains and the longest river is the Vltava. Other important rivers are the Labe, Jizera, Ohre, Svitava, Svratka, Dyje, Morava and the Oder. Fertile lowlands are found southern Moravia. The republic lies in the temperate zone and has got no coastline. The warmest areas are in Southern Moravia and the coldest areas are in the Giant Mountains. The average annual rainfall is about 600 mm.

The Czech Republic is a democratic state. Its government is divided into three spheres – the legislative, represented by the Parliament; the executive, represented by president and the government; and the judicial, represented by the courts. The Parliament, according to the constitution, consists of two chambers – the Chamber of Deputies (200 deputies, four year term) and the Senate (81 senators, two year term with, one third of Senators renewed).

Ecomomic Statistics

Share in the gross domestic product (GDP) by sector (%)		
	agriculture	5
	industry	41
	services	54
Share in employed civilian working population by sector (%)	agriculture	5
	industry	40
	services	55
Total exports ($ billion)		32,7
Share of export by commodity	machinery and transport equipment	44
	intermediate manufactures	25
	chemicals	7
	raw materials and fuel	7
Share of export by partner (%)	Germany	40,4
	Slovakia	7,7
	Austria	6,0
	Poland	5,4
	United Kingdom	4,3
Total Imports ($ billion)		$ 37,4
Share of import by commodity (%)	machinery and transport equipment	40
	intermediate manufactures	21
	chemicals	11
	raw materials and fuel	13
Share of import by partner (%)	Germany	26,7
	Russia	6,4
	Slovakia	6,0
	Italy	5,2
	Austria	4,9

Engineering (machine tools, locomotives, tractors and agricultural machines) is the most important sector of the economy. Other important branches are the metallurgical and chemical industries and tourism; the textile and glass industries have also got a long tradition. The Czech Republic possess large coal deposits. Black coal and anthracite are mainly found in the Ostrava Coal Basin, but also in the area of Kladno and elsewhere. Due to the intensive mining, the regions of Ostrava and Kladno are the most polluted ones in the Czech Republic.

Basically one of the most stable and prosperous transition countries, the Czech Republic has been recovering from recession since mid – 1999. Growth in 2000 and 2001 was led by exports to the EU, especially to Germany, and foreign investment, while domestic demand has been reviving. Uncomfortably high fiscal and current account deficits may cause problems in future. Unemployment (8,5 % in 2001) is gradually declining as job creation continues in the rebounding economy; the inflation rate (4,7%) is still moderate.

4 Czech Agriculture

Information about Czech agriculture are published by the Ministry of Agriculture of the Czech Republic in the " Report on the State of Agriculture in the Czech Republic in 2001" entitled "Green report" (www.mze.cz).

The development and conditions of agriculture in 2001 are described in the summary of "The Green Report". Its main conclusions are:

- the economic revival of the previous year has changed to a faster dynamic development than that attained by any of the European Union countries,
- agriculture in the Czech Republic achieved a positive result in 2001 similar to that of 2000,
- the area of the Czech agricultural land has not not changed significantly in 2001 compared to 2000. Agricultural land represents 54,2% of the total land area in the Czech Republic. In 2001 less favourable areas were precisely described and they account for 60,3% of agricultural land.
- the percentage of protected land, according to Act No. 114/92 coll. on Nature and Landscape Protection, for the overall area in the Czech Republic is 16,0%. The percentage of agricultural land grew markedly to 5,28% in 2001, whereof 5,1% are farmed organically.
- the gross agricultural production in fixed prices for 1989 grew slightly in 2001 compared to 2000,
- looking at the structure of planted and harvested areas it needs to be pointed out that the percentage of grains, potatoes, pulses and vegetables fell, while at the same time there was a growth of sugar beet and rape seed; annually there was a slight fall in the state of cattle and pigs,
- in 2001 there was faster growth in agricultural product prices than in the prices of agricultural inputs, which meant, similar to 2000, that there was a closure in the price gap,
- the indicator of the estimate for production subsidies rose slightly in 2001, overall it still remains below the level of EU or OECD averages,
- in comparison to 2000 the total expenditures for agricultural subsidies from the MoA´s budget rose in 2001 by 7,3%.

Some information about Czech agriculture are presented in the following figures. The total agricultural land is about 4,3 million ha. Arable land accounts for some 3,1 million ha. 33% or 2,6 million ha of the Czech Republic's land are used for wood and forests.

Table 1: Land use in the Czech Republic

	Agricultural Land (1999)	Arable Land (1999)	Forest Land (2001)
Area (in 1000 ha)	4.284	3.101	2.639
% of agricultural land	100	72	-
% of total land	54	39	33

Source: Ministry of Agriculture, 1999, 2001

Unlikely to other countries in transition, agriculture in the Czech Republic is not characterised by small scale farming. There are over 40.000 famers on land smaller 10 ha, but they only cultivate 2,5% of the total area.

Table 2: Distribution of farms by hectare in 2000

Size	Number of holdings	% of total number of holdings	Hectare of agriculture land	% of ha
<10 ha	41.012	72,6	90.259	2,5
10-50 ha	9.724	17,2	209.213	5,7
50-100 ha	1.844	3,3	128.596	3,5
100-500 ha	2.007	3,6	444.410	12,2
< 500 ha	1.900	3,4	2.770.691	76,1
Total	56.487		3.643.168	

Source: Agrocensus 2000

Table 3 present areas of crops grown in 2001. Interpreting these numbers one has to exercise caution although. Maize for silage for example is a annual fodder crop and does not account for maize.

Table 3: Acreage, yield, and production of major cultivated crops in 2001

Crop	Harvest area (in 1000 ha)	Yield (Mt/ha)	Production (in 1000 Mt)
cereals together	1.623,6	4,52	7.337,6
wheat	923,2	4,85	4.476,1
rye	40,1	3,72	149,3
barley	495,1	3,97	1.965,6
oats	47,8	2,85	136,4
maize	61,9	6,60	408,7
legumes together	37,2	2,46	91,4

Table 3: (continued) Acreage, yield, and production of major cultivated crops in 2001

Crop	Harvest area (in 1000 ha)	Yield (Mt/ha)	Production (in 1000 Mt)
potatoes together	54,1	20,88	1.130,5
sugar beet	77,7	45,41	3.529,0
fodder root crops	6,0	36,73	219,4
oilseed crops together	432,3	2,50	1.078,8
rape	343,0	2,84	973,3
poppy	33,2	0,64	21,3
flax (stems)	6,6	2,70	17,7
annual fodder crops	288,7	28,46	8216,5
perennial fodder crops (hay)	373,5	6,02	2250,0
vegetables	26,0	16,2	421,2
hops	6,1	1,09	6,6
grapevine	11,3	6,04	68,3
perennial meadows	656,6	3,27	2148,3
pastures	283,6	2,37	671,7
fruits together	30,6	9,69	296,3

Source: Ministry of Agriculture, 2002

5 Pesticide Use in the Czech Republic

The Czech Republic is one of the very few countries worldwide, which maintains a pesticide use reporting system and a permission system for selected pesticides. All professional users of pesticides are required to record their pesticide use in detail. Article § 29 on the Handling of plant protection products describes the details:

“(3) The use of plant protection products in the framework of commercial activities must be recorded in the way set down in the implementing regulation; the records shall be saved for a period of at least three years.

(4) The use of plant protection products labelled on the basis of the decision on their registration as highly toxic or toxic must be announced by the legal person or natural person using them in the framework of commercial activities to the district public health officer not later than 48 hours before the beginning of their application, with the exception of cases of a sudden attack on the plants by harmful organisms when the sufficient time span for the announcement will be by the beginning of the product application. The use of these plant protection products outside closed objects must also be announced to the locally competent municipality office within the same time limit. In the case of an aerial application, the announcement must be made in writing. The announcement shall include:

a) the exact name of the municipality and object, or municipality, cadastre and land where the product is to be used,

b) the sort, approximate amount and dosage rate or concentration of the product that is to be used,

c) the purpose of the use of the product,

d) the mode of application,

e) the day and, if possible, the hour of launch of the application,

f) the presumed duration of the activity,

g) the safety measures that will be performed,

h) the name and seat of the legal or natural person performing the application of the product, and the name of, and connection to, the person responsible.

(5) National holidays, public holidays, and days of rest (non-working days) are not included in the term of 48 hours as referred to in paragraph 4."[1]

In Annex 8 a model of recorded data is presented. Pesticide user have to record:

- enterpreneur using pesticide
- address of headquarter
- identification number of the organisation
- persion responsible for record keeping
- identification of the place the pesticide was used by municipality, cadastral district, plot number, location of treated buildings (cereal stores, greenhouses etc.)
- date and hour of use
- commodity, crop
- target organism
- pesticide product number
- dose per unit
- way of use
- extent of use in hectare or other units
- total quantity
- notes[2]

Farmers with farms larger than 10ha are required to report their pesticide use. Only 27,4% of all farms are larger than 10 hectare, but they do cultivate 97,5% of the agricultural land (see Table 2). Collected pesticide use, specific to active ingredients by crop are available. The annual report published by the State Phytosanitary Administration also contains information on the hectare infested with individual pest organisms by crop as well as on the use of pesticides

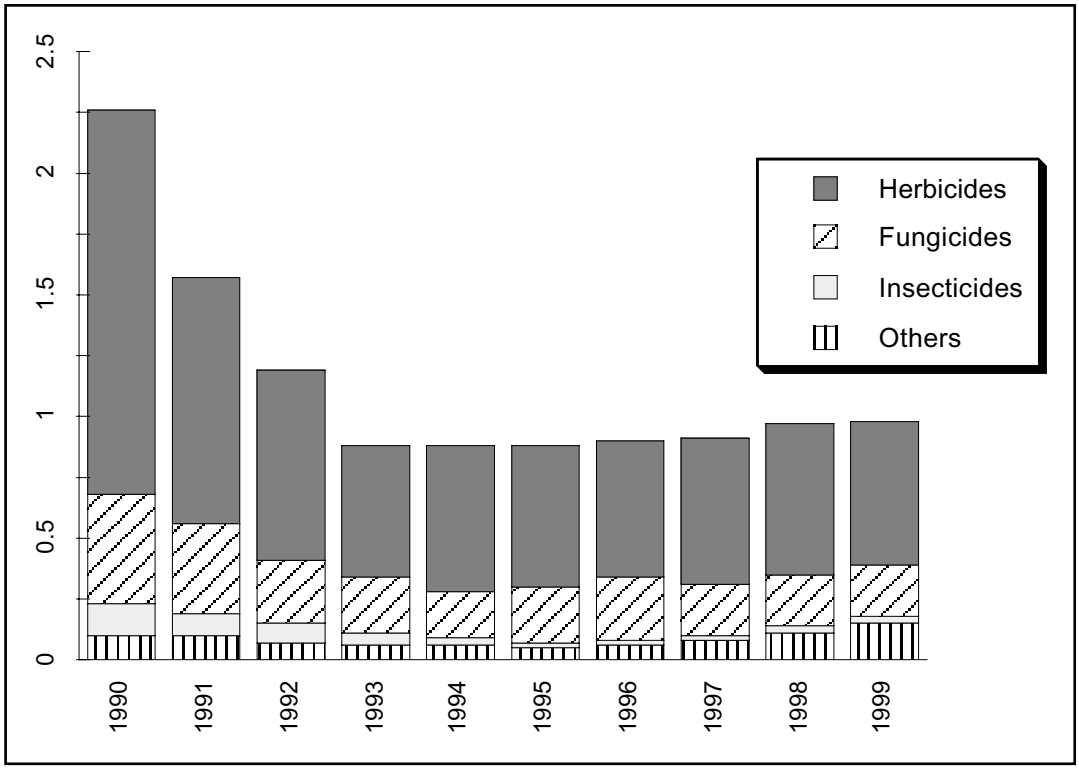
1 Czech Republic, Collection of Laws, Volume 2002, Issue 14 of 30 January 2002: 36/2002 Coll.Act No. 147/1996 Coll., on Phytosanitary Care and Amendments of some Related Acts, as Amended by the Acts No. 409/2000 Coll. and No. 314/2001 Coll.ACT on Phytosanitary Care and Amendments of some Related Acts PART ONE PHYTOSANITARY CARE SECTION I BASIC PROVISIONS

2 Annex No. 8 to the Decree No. 91/2002 Collection of Laws, Model of Recorded Data on the Uses of Plant Protection Products in Frame of Business

by toxicity classification and crop. The annual report, however does not contain information on trends over time or application rate by crop.

Due to the political changes in the end of the 1980ties the agricultural structure changed, too. Pesticide use had dropped considerably in the beginning of the 1990ties and has been on the rise since 1993. In 2002 the reported pesticide use was 4,7 million tons active ingredients, in 1993 the reported use was 3,5 million active ingredients.[3] [4]

Figure 1: Pesticide Use in kg/ha active ingredient 1990-1999



Source: Sarapatka, Dlapa, Bedrna (2002): Kvalita a degradace pudy (Soil quality and soil degradation) VUP Olomouc, 246 pp

Table 4 shows the reported amount of pesticide products and active ingredients. Herbicides contribute to the highest use followed by fungicides and growth regulators.

Table 4: Amounts of plant protection products and active ingredients used in 2001

Use Group	Plant Protection Product		Active Ingredients	
	(kg or l)	(kg or l/ha)	(kg or l)	(kg or l/ha)
additives	15.730	0,0035	13,462	0,0030
anti-transpirants	63.817	0,0142	36,871	0,0082
fungicides	2.088.367	0,4647	919,752	0,2047

3 State Phytosanitary Administration (2003):Pesticide Consumption and the Extent of Plant Protection Product's Treatment in the Czech Republic in 2002, Prague

4 Date 1993 from FAO Database www.fao.org

Table 4: (continued) Amounts of plant protection products and active ingredients used in 2001

Use Group	Plant Protection Product		Active Ingredients	
	(kg or l)	(kg or l/ha)	(kg or l)	(kg or l/ha)
herbicides and desinfectants	5.976.099	1,3299	2.584.384	0,5751
fungicides for seed treatment	457.933	0,1019	132.673	0,0295
insecticides for seed treatment	2.499	0,0006	738	0,0002
mycobacterial agents	15.908	0,0035	6	0,0001
oils	3	0,0000	1	0,0000
growth regulators active	794.210	0,1767	523.554	0,1165
repellents	1.812	0,0004	312	0,0001
rodenticides	256.840	0,0572	7,849	0,0018
zoocides	523.299	0,1164	168.729	0,0376
Total	10.196.446	2,27	4.388.332	0,98

Source: The State Phytosanitary Administration, 2001

Table 5 shows thetop 25 active ingredients used in 2001 and 2002. In 2002 the top 25 pesticides account for 73% of the total use.The changes between the two years cannot be interpreted as a trend, climatic conditions and/or changes in crop areas maybe responsible for such changes. Chlomequat-chloride, a growth regulator is the most frequently used chemical, followed by glyphosate and alachlor.

Table 5: Use of the top 25 pesticide in the Czech Republic in 2001 and 2002

	Active	2001 Total kg or l	Total 2002 kg or l	% change
1	Chlormequat-chloride	496.862	597.770	20,3
2	Glyphosate-IPA	313.167	293.321	-6,3
3	Alachlor	278.002	255.141	-8,2
4	Acetochlor	233.037	241.174	3,5
5	Mancozeb	181.131	186.817	3,1
6	MCPA	189.365	176.619	-6,7
7	Atrazine	131.321	144.919	10,4
8	Glyphosate-trimesium (sulfosat)	95.168	131.517	38,2
9	Isoproturon	158.178	129.961	-17,8
10	Copper oxycloride	137.126	128.757	-6,1
11	Chlorpyrifos	100.900	111.031	10,0
12	Carbendazim	92.290	109.516	18,7
13	Trifluralin	88.654	99.950	12,7
14	Glyphosate	40.443	95.608	136,4
15	Metazachlor	97.923	89.395	-8,7

Table 5: (continued) Use of the top 25 pesticide in the Czech Republic in 2001 and 2002

	Active	2001 Total kg or l	Total 2002 kg or l	% change
16	2,4-D	89.465	83.123	-7,1
17	Fenpropimorph	66.844	75.035	12,3
18	Thiram	61.149	74.087	21,2
19	Chlorotoluron	106.736	72.256	-32,3
20	Chloridazon	56.409	64.561	14,5
21	Carboxin	46.437	56.806	22,3
22	Sulphur	51.785	56.078	8,3
23	Pendimethalin	52.864	54.319	2,8
24	Metamitron	49.501	50.120	1,3
25	Dimethachlor	46.462	47.883	3,1
	Total Top 25	3.261.219	3.425.764	5,0

Source: State Phytosanitary Administration 2001, 2002

The use of the top 25 pesticides is illustrated in Table 7. The table shows that some pesticides are almost exclusively applied on one crop. The list of the top 25 contains a number of very toxic and environmentally hazardous compounds. A comprehensive evaluation of pesticides authorised in the Czech Republic is done in the second part of this publication.

In Table 6 the application frequency for major crops is calculated. In 1976 the ratio of the treated area to the total planted area for corm and maize was 1. This means, theoretically, that the entire planted area had been treated once.

Table 6: Application frequency of pesticides in the Czech Republic (ratio of treated area to total area of crop)

Crop	1976	1990	1995	1999
corn	1.00	1.80	1.32	1.47
maize	1.00	1.10	1.10	1.14
legumes	2.00	2.10	1.50	1.70
sugar beet	3.30	3.50	3.24	3.36
potatoes	3.10	5.60	3.46	3.14
rape	1.70	2.60	2.53	3.12
hops	11.60	11.00	6.10	5.10
alfalfa	0.12	0.23	0.05	0.08
pastures	0	0.04	0.01	0.01

Source: Sarapatka, Dlapa, Bedrna (2002): Kvalita a degradace pudy (Soil quality and soil degradation) VUP Olomouc, 246

Table 7: Use of the top 25 pesticides by crop in kg in 2001

	Arable Crops							Specialty Crops				
Active	Cereals	Maize	Legumes	Sugar Beet	Potatoes	Forage Crops	Rape	Hops	Vegetables	Orchards	Vine	Other Crops
Chlormequat-chloride	400.680	0	0	0	0	471	95.539	0	1	0	0	172
Glyphosate-IPA	116.089	11.076	5.360	2.564	875	7.732	12.558	334	205	7.258	4.103	145.010
Alachlor	192	1.377	197	0	260	59	273.231	0	854	0	0	1.831
Acetochlor	369	205.066	282	302	0	0	1.755	0	0	0	0	25.262
MCPA	177.792	780	0	0	5	4.513	288	518	0	2.226	60	3.183
Mancozeb	1.354	0	94	4	130.735	1	190	0	14.762	20.401	10.395	3.196
Isoproturon	147.066	0	0	342	0	0	0	0	99	0	0	10.671
Oxychlorid m_di	0	0	5	627	11.795	1	66	92.238	5.060	11.814	14.933	587
Atrazine	27	131.173	0	0	0	12	0	0	0	5	0	104
Chlorotoluron	93.808	0	0	0	0	69	24	0	5	0	0	12.831
Chlorpyrifos	2.152	722	1.441	2.317	2.811	161	88.778	0	468	572	28	1.450
Metazachlor	0	0	0	0	0	3	92.166	0	1.040	38	0	4.676
Glyphosate-trimesium	31.153	2.701	1.335	618	15	2.214	6.387	65	286	5.491	1.655	43.248
Carbendazim	73.333	0	67	6.612	0	3	9.573	0	0	24	0	2.678
2,4-D	81.945	7.055	0	0	0	164	52	0	0	14	0	236
Trifluralin	54.639	0	599	46	0	0	13.964	25	2.654	0	0	16.726
Fenpropimorph	66.828	0	0	0	0	0	0	0	1	0	0	15
Thiram	52.727	233	389	0	7	0	116	0	14	7.664	0	0
Chloridazon	0	0	0	56.409	0	0	0	0	0	0	0	0
Pendimethalin	35.363	309	10.330	2	0	132	0	0	4.359	286	0	2.084
Sulphur	893	0	0	0	0	0	0	0	177	18.320	32.226	169
Metamitron	0	0	0	49.481	0	0	0	0	19	0	0	0
Dimethachlor	0	0	0	0	0	0	46.393	0	0	0	0	68
Carboxin	45.678	233	389	0	7	0	116	0	14	0	0	0
Glyphosate	10.910	533	254	88	6	1.147	2.442	0	42	1.245	882	22.893

6 Production and Trade of Pesticides

There are 3 producers of active substances of plant protection products (PPPs) in the Czech Republic: Aliachem; Lucebni zavody Draslovka; Nera Agro; out of which Aliachem a.s. is the only comparatively important one. The following table shows the volume of production for Aliachem; data regarding the remaining two producers are not available.

Table 8: Pesticide production in volume of production of active substances by Aliachem

Pesticide	VOLUME OF PRODUCTION 2000 (Mt)	VOLUME OF PRODUCTION 2001 (Mt)
Desmedipham	19.2	49.425
Phenmediphan	82.375	104.775
Chlortoluron	61.009	0
Propamocarb	14.009	20.36
Asulam	5.328	24.344
TOTAL	181.921	198.904

Source: Aliachem – firm material, 2002

There are 11 producers of formulated PPPs in the Czech Republic: Aliachem, Bochemie, Agrochema Studenec, Tora, Agrochemie Zlin, Finstar, Libar, Lucebni zavody Draslovka, Nera Agro, Prost, Sluzba v.d. Ostrava.

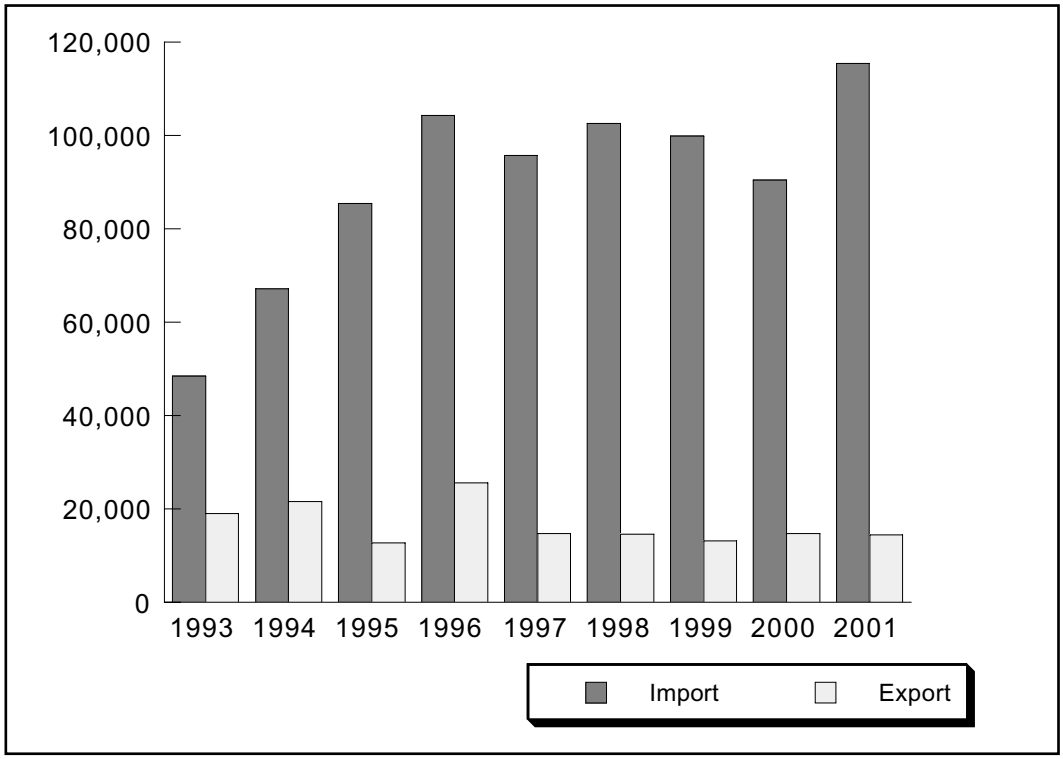
No figures concerning the number of importers / exporters of PPPs is currently available. The following is the only available data on the volume of trade, as recorded in the customs statistics.

Table 9: Export and import of pesticides in the Czech Republic in 2001

Product	Product Description	Import (kg)	Export (kg)
380810	Insecticides, packaged for retail sale or formulated	1.767.080	1.912.826
380820	Fungicides, packaged for retail sale or formulated	3.192.637	847.520
380830	Herbicides, anti-sprouting products & plant growth regulators, packaged for retail sale or formulated	7.934.377	2.964.254
380840	Disinfectants, packaged rof retail sale or formulated	4.162.123	3.363. 215
380890	Pesticides including rodenticides, nes, packaged for retail sale or formulated	943.343	1.201.705
Total		17.999.560	10.289.520

Source: The State Phytosanitary Administration - statistics

Figure 2: Export and import of pesticides in the Czech Republic in VAL $1000



Source: FAO, www.fao.org

7 Pesticide Authorization

The State Phytosanitary Administration (SPA) is an administrative body of the Ministry of Agriculture of the Czech Republic. It is responsible for the authorization of pesticides. The National Institute of Public Health, a body of the Ministry of Health, is also involved.

Act No. 147/1996 Coll. as amended by law No. 409/2000 Coll. and No. 314/2001 Coll. on the Phytosanitary Care with Regulation No. 92/2002 regulates the authorisation of plant protection products on the market, control over the products on the market, and over the users. It transposes most of the articles of Council Directive 91/414/EEC including Article 17 which establishes requirements on the control over marketing and use of plant protection products. At present, a draft of the new law on the authorisation of plant protection products is being prepared. It will come into force after the accession of the Czech Republic to the EU and will fully comply with Council Directive 91/414/EEC. That draft is being prepared in cooperation with PSD York within the framework of the Phare Twinning project.

Information on authorized PPP for NGO´s, advisors, farmers, can be found in the annual list of registered preparations for plant protection, which represents information on source and disposal. Mandatory information is indicated on preparation packagings, too. Information is also available at web site www.srs.cz (State Phytosanitary Administration).

The State Phytosanitary Administration is responsible for the registration of PPPs. It is directly subordinated to the Ministry of Agriculture and functions as the national central authority of the Czech Republic in the phytosanitary field for the ”plant health (harmful organisms)“ and “plant health (pesticides)“ sub - sectors, according to Act No. 147/1996 of the Law Book and in accordance with Art. 2(11) and 17 of the Council Directive 91/414/EEC.

The National Institute of Public Health (NIPH) is responsible for the assessment of toxicological properties of PPPs and concerned with human health during the registration process. The authorization procedure is presented in Figure 3.

The list of plant protection products contain 556 registered chemical products, including those recorded biological products based on macroorganisms and microorganisms on 20 September 2002.(hab an dieser stelle aus versehen einige worte gelöscht, nun ist mir der zusammenhang nicht mehr ganz klar)

The SPA annually issues its official “List of Registered Plant Protection Products”. It also states the list of approved active ingredients in the plant protection products in the Czech Republic. The Official List includes the chemical preparations, the preparations based on microorganisms and approved biological agents (“macroorganisms“). It is also available in electronic format at the SPA official web site. The web sites are regularly up-dated. Changes to the Official List throughout the year are published as appendices in paper form.

7. 1 Transposition of EU Legislation

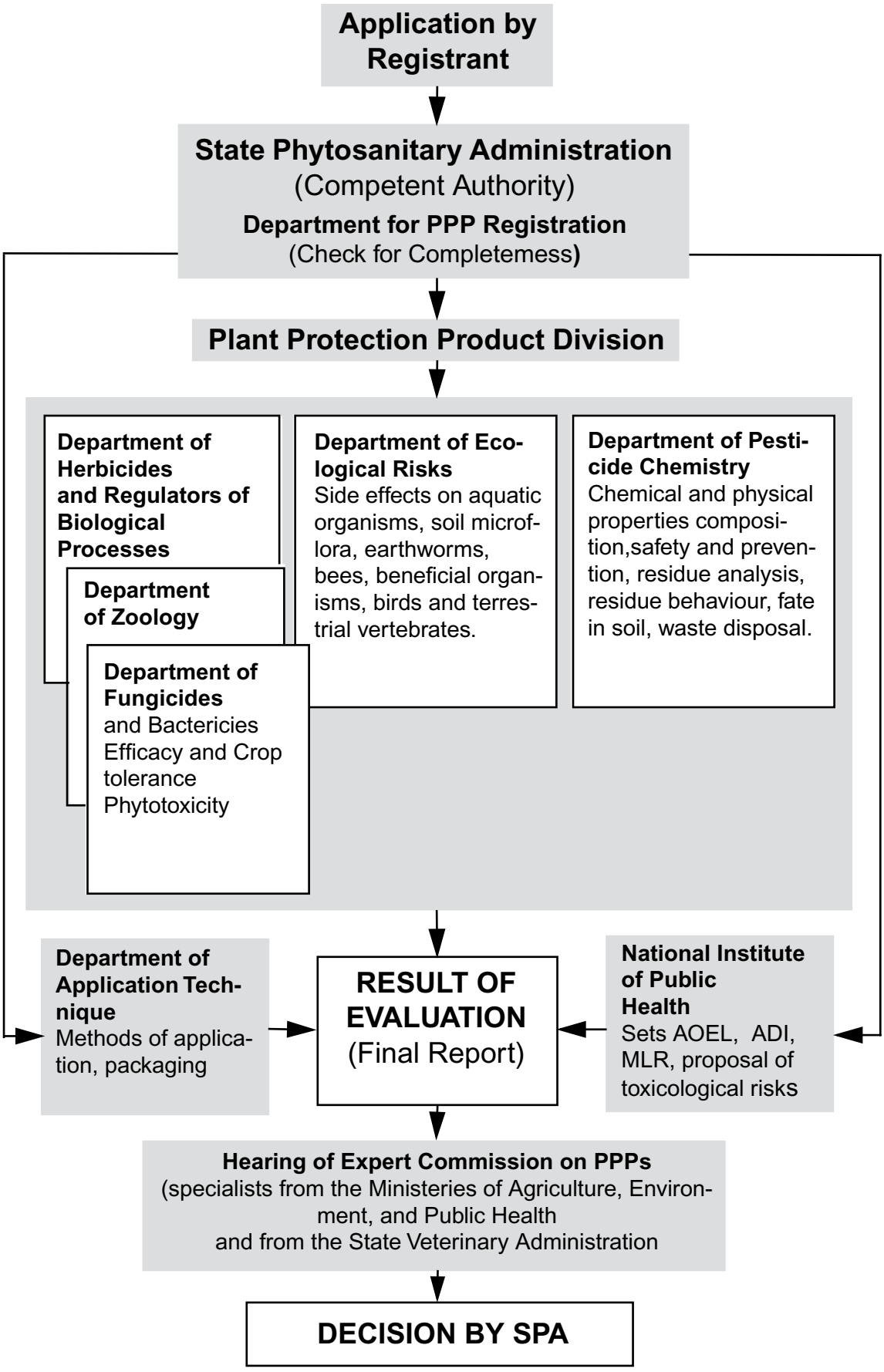
Transposition of EU legislation has been ensured through the harmonization of the legal system of the Czech Republic. Through a technical analysis of relevant EU legislation an important step has been introduced in the beginning of the legislative process on which draft amendments to the existing CZ legislation and/or proposals for the new legal acts shall be based.

The State Phytosanitary Administration has got the technical responsibility, while the Ministry of Agriculture is responsible for the general legislative aspects of the process.

Table 10: Transposition process for main EU legislation regarding plant protection products

EU legislation on plant protection products	Current status of transposition	National legislation currently in force	(Planned) date of full trans-position	(Planned) date of entry into force
91/414/EC (placing of PPPs on the market)	partly	Act 147/1996 (consol 36/2002); Decree 91/ 2002	IV Q 2003	upon accession
1999/45/EC (classification packaging and labeling of dangerous prep.)	partly	Act 157/1998 (as amended)	II Q 2002	01.07.2003
79/117/EEC (prohibiting marketing and use of PPPs containing certain active sub. ces)	fully	Act 147/1996 (consol 36/2002); Decree 91/ 2002	-	-
76/769/EEC (restriction on certain dangerous sub. ces and preparations)	partly	Act 157/1998 (as amended)	II Q 2002	01.07.2003
67/548/EEC (on the classification, packaging and labelling of dangerous sub.)	partly	Act 157/1998 (as Amended)	II Q 2002	01.07.2003

Figure 3: Czech Authorization Procedure of Plant Protection Products



7. 2 Pesticide Use Requirements

Farmers who use plant protection products (for the purpose of enterprise) are obliged to carry out the following requirements:

- To keep records of the use of plant protection products (Act No. 147/ 1996 – Article 29; Decree 91/2000 – Article 15);
- Equipment for application has to be registrated (recorded in the central register) and tested once every two years at least. Act No. 147/1996 – Articles 35, 36, 37; Decree 91/2000 – Articles 21 / 29);
- Complete special training for the use of plant protection products.

Within the SPA, IPM and GPPP instructions are combined and published in “Instructions for plant protection“ and in “Methods of prognosis and warning“. The SPA makes prognoses of occurrence of some pests and diseases.

The desirable reduction of the use of chemicals in agriculture has been addressed and supported by the subsidiary program of the Ministry of Agriculture “Biological Pest Control to Supersede Chemical Treatment“ (No. 3.a.).

8 Monitoring of Pesticide Use and Handling

SPA inspectors, approximately 250, carry out the control of marketing and use of plant protection products. The SPA inspectors work at regional and local levels. Traders in plant protection products are registered at the Commercial Register of Ministry of Justice of the Czech Republic. The SPA itself does not register these subjects.

Inspections are mostly carried out at retail ontlets, sellers and farmers. Regarding to the application of plant protection products, the controls are carried out in the fields at time of application.Table 11 presents the subjects and the number of inspection in 2000 and 2001.

Table 11: Subject and number of inspection

Subject of Inspection	2000	2001
Packaging and labelling	246	209
Conditions of storage	256	332
Record of the use of pesticides	1180	1096
Application and dosage	441	419

9 Pesticide Residue Monitoring

Pesticide and residue monitoring is pursued by two spheres: the agriculture and health services. The Central Institute of Supervising and Testing in Agriculture is responsible for soil monitoring, the Czech Agriculture and Food Inspection Authority controls foodstuff quality, and the National Institute of Public Health monitors drinking water

9. 1 Pesticide Residues in Soil

The Central Institute for Supervising and Testing in Agriculture (Brno), Department of Agrochemistry, Soil and Fertilizing pursues soil monitoring.

Other tasks of the department are:

- monitoring of physical, chemical and biological properties of soil in a network of monitoring areas on arable land, atmospheric deposition monitoring inclusive of coordination and evaluation on behalf of the Ministry of Agriculture of the Czech Republi
- forest soils research, forest tree nutrition
- governmental supervising appertaining to fertilizer treatment, soil incoming substances control (sewage treatment plant sludge, etc.)
- arbitragement and expert activity in agrochemical soil´s properties assessement and soil contamination evaluation.

The content of organochlorine pesticides was observed at observational sites over three years (1994 – 1996). In the years 1998 and 1999 these substances weren´t set. At present, the results of the observations of the years 2000 and 2001, when the samples were taken away from constant file of observational sites (35 observational sites on arable land, 5 observational sites in landscape protected areas), are available.

Overall results are given in the following figure.

Table 12: Main statistical parameters of individual organochlorine pesticides in the topsoils and subsoils of arable land during the years 2000, 2001. (mg.kg -1 solid; 36 samples/pesticide/year)

	2000			2001		
Topsoil	Arithmetic mean	Min.	Max.	Arithmetic mean	Min.	Max.
HCB	2.26	< 1	9.94	4.54	0.60	19.0
p.p´-DDT	81.3	< 10	467	52.4	1.00	421
o.p´-DDT	35.7	< 10	369	10.8	0.50	95.6
p.p´-DDE	24.6	< 1	388	45.7	3.00	589
o.p´-DDE	1.60	< 1	25.7	1.82	0.50	17.2
p.p´-DDD	4.6	< 1	40	4.5	0.50	37
o.p´-DDD	1.65	< 1	18.5	1.90	0.50	17.8
Subsoil						
HCB	1.59	0.35	17.48	2.34	0.25	12.8
p.p´-DDT	46.7	< 10	285	26.3	0.50	340
o.p´-DDT	22.7	< 10	248	7.0	0.50	86.9
p.p´-DDE	15.4	< 1	274	22.0	0.50	217
o.p´-DDE	1.05	< 1	11.7	1.56	0.50	29.2
p.p´-DDD	2.8	< 1	24	2.7	0.50	24
o.p´-DDD	1.29	< 1	10.1	1.26	0.50	10.8

The OCP detection in the topsoils and in the subsoils were completed in the year 2001. It was made on a consistant file of 35 observational sites on arable land and 5 observational sites in landscape protected areas. These results make it possible to compare them with those ones

from 2000 and for orientation perposes with results from 1997. No sample exceeded the limit of quantification relating to HCH. During the year 2001 the value of HCB increased in comparison to the year 2000, but absolute values remain low. The bigger value of content had the metabolite p.p´- DDE. The metabolites o.p´- DDE and both p.p´and o. p´ - DDD have values at the same level in both years. The active contents in the subsoil are at about half the level of the topsoil. During both years transcendence of limit values in DDT (in accordance with directive No. 13/1994 Coll. as well as proposed preventive limits) occured. The count of overdrawn values decreased in 2001; the proposed preventive limits for DDE decreased, too. The contents of these substances remain a problem in agriculture.

9. 2 Monitoring of Drinking Water

The year 2001 was the eighth year of the routine "System of Monitoring Population Health in Relation to the Environment" based on Resolution No. 369 of the Government of the Czech Republic, 1991. The subsystem "Health Consequences and Risks from Drinking Water Quality" has been part of this monitoring from the very beginning. In 2001 all 30 selected districts continued their participation in this subsystem. The answerable authority for this task is the National Institute of Public Health which performes the monitoring in cooperation with county hygienic stations.

The cities within the monitored areas, supply drinking water to a population of about 3.5 million, which is about one third of the population of the Czech Republic, and to over 60% of the population living in cities with populations over 20, 000.

The legally binding background for drinking water quality assessment in 2001 was the Decree of the Mott of the Czech Republic No. 376/2000, based on the WHO recommendations of 1993 and partly harmonized with the EU Council Directive 98/83/EC on the quality of water intended for human consumption.

Through monitoring attention is paid to pesticides from organic contaminantes, the average value of 173 analysis was 0.015 µg/l pesticides (total) in 2001 (Source: National Institute of Public Health – statistics).

9. 3 Food Monitoring

The Czech Agriculture and Food Inspection Authority (CAFIA) belongs to the Ministry of Agriculture of the Czech Republic and is responsible for foodstuff monitoring.

The cardinal directive is a law about foodstuff No. 110/1997 Coll. and its executive notices. The control of extraneous substances limits is provided by notice No. 53/2002 Coll. Aromatic Substances Control notice No. 52/2002 Coll. issued by the Ministry of Health of the Czech Republic. Certain kinds of pesticides are monitored permanently (examples in the table) next to those which could have occured. Plant products are controlled both randomly and deliberately. Animal products are under supervision of the State Veterinary Administration of the Czech Republic in accordance with law No. 166/1999 Coll. on veterinary care.

The majority of legal directives of the Czech Republic has already approximated to EU- directives. Regulations are fully accepted and Directives are transposed.

Public relations of CAFIA have been found which provides information in accordance with law No. 106/1999 Coll.. Topical problems are released by news, media and annual reports about activities are accessible, additionally information is available at web site www.czpi.cz.

CAFIA inspectors carried out 22,122 inspections in 2001. 12,219 inspections were completed in the retail network, 8,080 in production, 1,704 in stocks and 119 of them in other places. CAFIA regularly monitors more than 100 active ingredients and metabolites related to fungicides and insecticides both from the category of organochlorines, and organophosphates and some of the other pesticide categories. The residues of a pesticide are monitored in the following commodities: potatoes. apples. cabbage. flour. bread. rice. children´s nourishment and citrus. The pesticides based on bromide (methyl bromide) used for stock protection (fumigation) were monitored in tea, spice, cocoa powder, dried fruit and nuts.

7 positive results of pesticide residues were found during 2001 in citrus. The active phenylphenol (o- phenylphenol) was found in four cases and brompropylate, chlorpyrifos and methidathion were detected in one sample.

Apples were the commodity with the greatest number of detected pesticide residues in 2001 (Table 12) and imported apples from Spain and Argentina exceeded the maximum residue limits (MRL).

Table 13: Pesticide residue in apples (mg/kg) in 2001

	n	n posit. Residues up to MRL	% n posit. Residues up to MRL (%)	n+ Residues above MRL	% n+ Residues above MRL (%)
azinphos-methyl	11	2	18,18	2	18,18
bifenthrin	4	1	25	1	25
brompropylate	11	1	9,09	0	0
captan	11	2	18,18	0	0
diazinon	11	1	9,09	0	0
dithiocarbamtes	11	2	18,18	0	0
phosalone	11	1	9,09	0	0
procymidone	11	1	9,09	1	9,09

Source: CAFIA – statistics 2001

Dithiocarbamates were dedetected in apples, potatoes and especially in cabbage. The pesticide were found in nine out of twelve cabbage samples (75%).

The occurrence of organochlorine pesticides in milk, butter and cheese has been long determined by CAFIA. Average values of DDT which were found in milk and butter during the years 1992 – 2001 are shown below. The residues of the obsolete pesticides HCB, DDE and DDE,

found in 2001 didn´t eceed the MRLs, the percentage of samples with residues is shown in table 13.

Table 14: Residue of organochlorine pesticide in milk products

	Residues up to MRL (%)		
Chemical	Butter (samples = 21)	Milk (samples = 20)	Cheese (samples = 15)
hexachlorbenzen (HCB)	52,38	20	40
lindan (gama HCH)	0	0	0
total DDT	33,33	50	26,67
4.4´- DDE		50	26,67

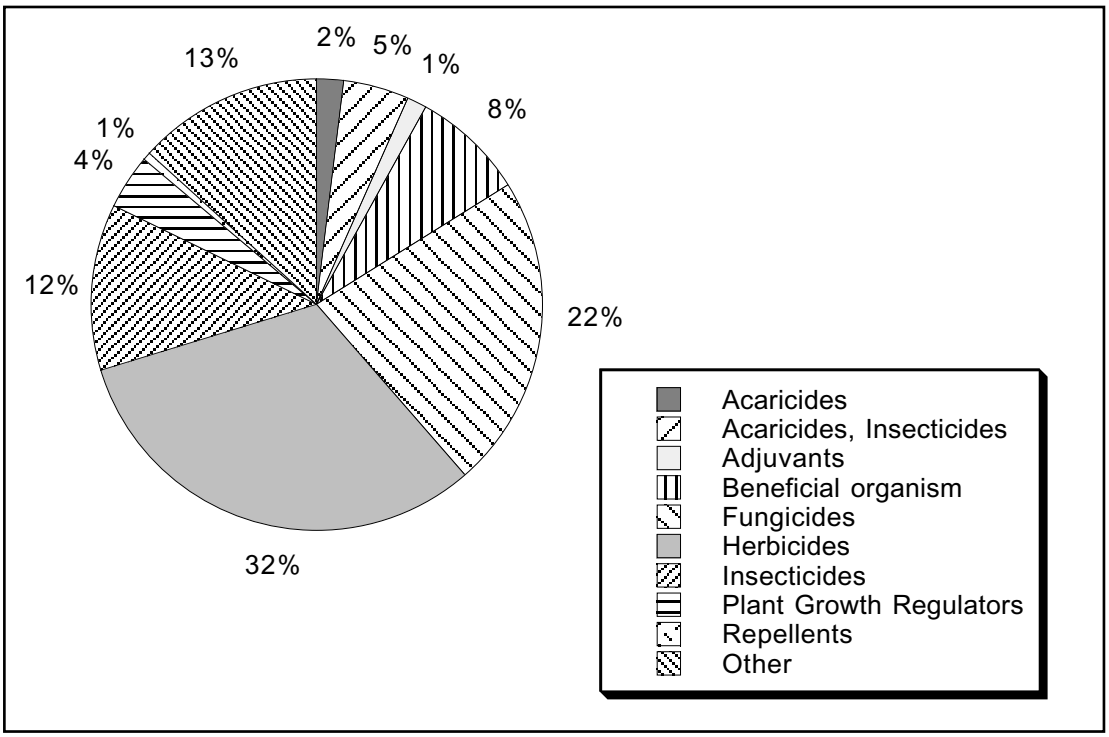
Source: CAFIA – statistics 2001

In 2002, CAFIA took 2621 food samples, in which a total number of 106 236 analyses were performed. Pesticide residues above the maximum residue limits (MRL) were detected in 44 samples or 0,04 %, in red or green pepper, lettuce, tomatoes, mandarins and apricots. The most often detected pesticides were endosulfan, chlorothalomil, malathion and dicofol (CAFIA – statistics 2002).

10 Characterisation of Authorized Pesticides in the Czech Republic

The list of the pesticide active ingredients authorized in the Czech Republic was obtained from the State Phytosanitary Administration of the Czech Republic. The list from 2002 includes 340 substances authorised for use in pesticide products in the Czech Republic. Substances which are not pesticide active ingredients such as synergists, adjuvants, safener, plant growth regulators and beneficial organism are also listed. Figure 4 shows the major use types of the 340 substances.

Figure 4: Major use types of substances authorized for use in pesticide products



Source: State Phytosanitary Administration of the Czech Republic; Use types PAN Database

Figure 4 summarises the major use types, Table 15 presents the specific type of use and the number of substances assigned.

Table 15: Authorized substances and their use types

Use Type	Abbreviation	Number of Substances
Major Use Types		*294*
Acaricides	AC	7
Acaricides, Insecticides	AC, IN	16
Adjuvants	AD	4
Beneficial organisms	beneficial organism	28
Fungicides	FU	76
Herbicides	HB	109

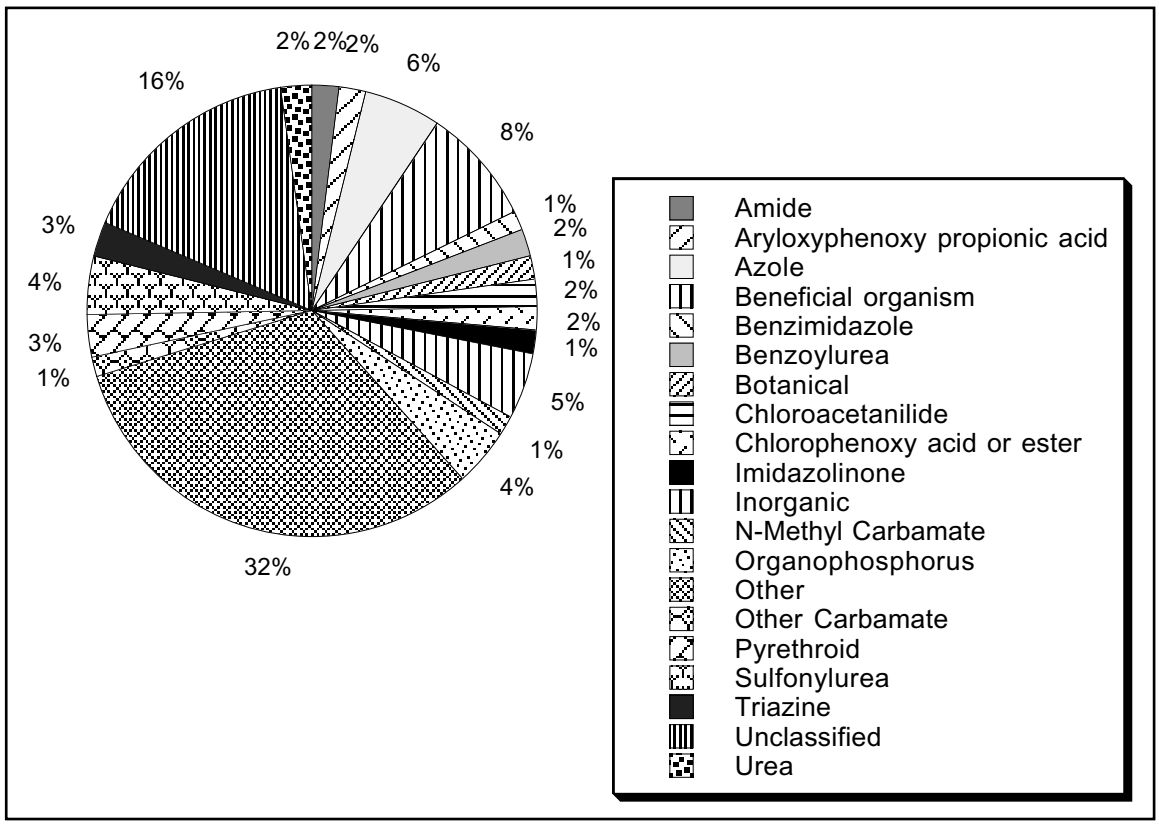
Table 15: (continued) Authorized substances and their use types

Use Type	Abbreviation	Number of Substances
Insecticides	IN	41
Plant Growth Regulators	PG	13
Repellents	RE	2
Other Use Types		*45*
Acaricides, Fungicides	AC, FU	2
Bacteriocides, Fungicides	BA, FU	2
Herbicides, Fungicides, Insecticides, Nematicides	HB, FU, IN, NE	1
Herbicides, Acaricides, Insecticides, Nematicides, Fungicides, Rodenticide	HB, AC, IN, NE, FU, RO	1
Insect attractants	Insect attractant	4
Insecticides, Nematicides	IN, NE	1
Insecticides, Rodenticide	IN, RO	2
Molluscicides	MO	1
Not specified	Not spec.	18
Plant Growth Regulators, Herbicide	PG, HB	3
Repellents, Molluscicides	RE, MO	1
Rodenticide	RO	2
Safeners	Safener	3
Solvents	Solvent	2
Synergists	Synergist	1

Source: State Phytosanitary Administration of the Czech Republic; Use types PAN Database.

Existing database was used to determine the chemical classes of the authorized substances. Figure 5 shows the major chemical classes of the substances. Chemical classes with 4 or less substances are summarised as Other in the figure.

Figure 5: Major chemical classes of substances authorized for use in pesticide products



Source: PAN Database

Appendix 1 lists all 340 substances with their use types and chemical classes.

Recources to pesticides characteristics:

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

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

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

11 Regulatory Status

All substances listed in Appendix 1 are registered for use in the Czech Republic. In the European Union two legal instruments regulate pesticide active ingredients.

11. 1 Pesticide Authorization in the European Union - Council Directive 91/414 EEC

The authorization of pesticide active ingredients is regulated through Council Directive 91/414. Major goal of the Directive is to harmonize the authorization of plant protection products, and the establishment of a positive list of active ingredients on its Annex 1. Member States can only authorize plant protection products containing active ingredients listed on Annex 1, and under consideration of its efficiency, human toxicity, environmental fate, impact of non-target organism and other aspects listed in Article 4 of Directive 91/414.[5] 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.[6] However, if a Member State can proof that for pesticides active ingredients which are excluded from Annex 1 efficient alternatives do not exist and their further use is essential, it is possible that such substances can receive temporary authorisation until 30th June 2007. These temporary authorizations are limited to use on specific crops in the Member State concerned and should allow the Member State to search for alternatives. Presently, 13 Member States received authorisation for altogether 52 active ingredients, which uses otherwise expire by July 2003.[7]

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 the Czech Republic 16 new active ingredients received authorization.

In the Czech Republic 17 of the 30 Annex 1 pesticides are authorized. For 30 pesticides, which are authorized in the Czech Republic, authorization will expire in July 2003 in the European Union, 13 of them received authorisation for “essential uses” until June 2007. 8 pesticides, which are authorized in the Czech Republic, authorization already expired in the EU. 162 of the pesticides authorized in the Czech Republic are still in the EU re-evaluation process.

5 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

6 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

7 European Union (2002): Commission Regulation (EC) No 2076/2002 of 20 November 2002, Official Journal 319/3, Brussels, Belgium

Appendix 1 lists the 340 pesticides authorized in the Czech Republic 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.

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

11. 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.[8] Table 16 presents substances listed in Annex X of Directive 2000/60/EEC, which are ingredients of pesticide products, and their regulatory status in the Czech Republic.

Table 16: Priority substances used as pesticide or in pesticide products and their regulatory status in the Czech Republic

Substance	Use type	Priority Substance	Priority & Dangerous Substance	Authorized in the Czech Republic
Alachlor	Herbicide	Yes		Yes
Atrazine	Herbicide	Yes	Yes***	Yes
Benzene	Solvent	Yes		No
Chlorfenvinphos	Insecticide	Yes		No
Chloroform	Solvent, Fumigant	Yes		No
Chlorpyrifos	Insecticide	Yes	Yes***	Yes
Diuron	Herbicide	Yes	Yes***	No
Endosulfan	Insecticide	Yes	Yes***	Yes
Endosulfan - alpha	Insecticide			No
Ethylene dichloride	Fumigant, Insecticide	Yes		No

8 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 16: (continued) Priority substances used as pesticide or in pesticide products and their regulatory status in the Czech Republic

Substance	Use type	Priority Substance	Priority & Dangerous Substance	Authorized in the Czech Republic
Hexachlorobenzene	Fungicide, Microbiocide	Yes	Yes	No
Hexachlorocyclohexane	Insecticide	Yes	Yes	No
Isoproturon	Herbicide	Yes	Yes***	Yes
Lindane	Insecticide	Yes		No
Methylene chloride	Solvent	Yes		No
Naphthalene	Insecticide	Yes	Yes***	No
Nonyl phenol	Adjuvant		Yes	No
PCP	Wood Preservative, Microbiocide, Algaecide, Fungicide		Yes***	No
Pentachlorobenzene	not specified			No
Simazine	Herbicide		Yes***	Yes
Trichloromethane	Solvent	Yes		No
Trifluralin	Herbicide		Yes***	Yes

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

Source: European Commission

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

11. 3 International Conventions

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

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

The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was adopted in Rotterdam on 10 September 1998. The Prior Informed Consent (PIC) Procedure is voluntary, but it has been unanimously accepted by member countries of the Foos and Agricultual Organisation (FAO) and the United Nations Environmental Programme (UNEP) and is supported by the leading

chemical industry associations. 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.[9] Table 17 list all PIC pesticide, their type of use, and their regulatory status in the Czech Republic.

Table 17: PIC Pesticides and their Status of Authorization in the Czech Republic

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

9 www.pic.int

Table 17: PIC Pesticides and their Status of Authorization in the Czech Republic

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

Recources to POPs and PIC Convention:

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

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

12 Human Toxicity Classification and Health Effects of Pesticides Authorized in the Czech Republic

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)[10] will be used to evaluate the acute toxicity of the pesticide authorized in the Czech Republic. 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 the Czech Republic can be found in Appendix 2. A number of substances were excluded from the evaluation list, these are beneficial organisms, inorganic compounds such as boric acid and zinc, unclassified substances such as vegetable oils, pheromones, all adjuvants, safeners, synergists, plant growth regulators and botanicals. Altogether 94 substances were excluded. The exclusion was done because toxicity information for most of these compound is not available.

The following Chapter have largely been taken from two studies: Beyond POPs - Evaluation of Evaluation of the UNEP Chemical Substitutes of the POPs Pesticides Regarding their Human and Environmental Toxicity[11] and from the Risk Study in From Law to Field - Pesticide Use Reduction in Agriculture - From Pesticide Residue Analyses to Action.[12]

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

12. 1 Acute Toxicity - World Health Organisation (WHO)

191 of the ingredients authorized in the Czech Republic are classified by the WHO: 4 as Extremely Hazardous, 7 as Highly Hazardous, 34 as Moderately Hazardous, 47 as Slightly Hazardous and 99as 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.[13] 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 18. 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[14] [15] 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 18: WHO Recommended Classification of Pesticides by Hazard

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

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

11 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

12 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

13 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

14 "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 15.)

15 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

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.

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

12. 2 Acute Toxicity - European Union

131 of the ingredients authorized in the Czech Republic and evaluated are classified by the European Union: 12 as Very Toxic, 25 as Toxic, 70 as Harmful and 11 as Irritant.

The major legislative framework in force dealing with dangerous substances in the European Union is the Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.[16] 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.[17] 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.[18] 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.

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

16 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

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

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

effects on health such as carcinogenicity, mutagenicity and reproductive toxicity will be addressed in Chapter 12. 7.

The toxicity of the ingredients authorized in the Czech Republic, 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 19: 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.

12. 3 Cholinesterase Inhibition

19 of the ingredients authorized in the Czech Republic 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.[19]

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.

19 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

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[20] 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...."[21]

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.[22]

12. 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 12. 3.

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

20 Reference Dose, (note of the author)

21 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

22 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

12. 5 Carcinogenicity Classification - International Agency for Research on Cancer (IARC)

18 of the ingredients authorized in the Czech Republic are evaluated by the IARC: 7 as possibly carcinogenic to humans. 11 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.[23]

The evaluation leads to a classification which is divided into five groups as displayed in the Table 20.

Table 20: IARC Classification on Carcinogenicity

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

None of the ingredients registered in the Czech Republic 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 the Czech Republic are classified as possibly carcinogenic to humans (Group 2B). This classification is applied when limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals exist. It also may be used when adequate evidence of carcinogenicity in humans does not exist but there is sufficient evidence of carcinogenicity in experimental animals. In some cases, a sub-

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

stance 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. Eleven 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.

12. 6 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.[24]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.[25] 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 21: 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.

24 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

25 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 22: 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 23: 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 the Czech Republic and their cancer category assigned by U.S. EPA. Reflecting the classification date, all three types of categories can be found in Appendix 2.

12. 7 Classifications of Carcinogenic, Mutagenic and Reproductive Toxicants - European Union

14 of the ingredients authorized in the Czech Republic cause concern for humans due to possible carcinogenic effects and have been placed into the carcinogenicity category 3 by the EU. 7 cause concern for humans owing to possible mutagenic effects and have been placed into the mutagenicity category 3; 1 is placed into the mutagenicity category 2 and should be regarded as if it is mutagenic to humans; 4 may cause harm to the unborn child and 8 present possible risks of harm to the unborn child; and 4 pose the risk of impaired fertility.

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.[26] In the 18th amendment[27] 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.[28] 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.

26 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

27 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

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

Carcinogenicity

The European Union defines three categories for carcinogenicity, which are presented in Table 24. There are inherent difficulties in assigning substances into Category 1 due to the fact that this is done on the basis of epidemiological data.[29] Therefore it seems to be impossible to classify products which have been on the market for a short time or for products with a low volume of production i.e. low exposure potential. The exact processes and the principles of assessment to place a substance in Category 1 have not been documented.

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

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

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

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 24: 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

29 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 24: (continued) EU Classification of carcinogenic substances

Category	Description	Symbol & Risk Phrases
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
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 25. With Directive 2000/32/EEC of 19th May 2000 the European Union modified the Directive 67/548EEC for the 26th time.[30] 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 41) 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.

Seven of the Pesticides Authorized in the Czech Republic 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.

30 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

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

Table 25: 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.
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.[31]

Table 26: 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.

12. 7. 1 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.[32]

The ADI values can be found in Appendix 2. For 85 of the valuated pesticides an ADI value has been assigned.[33]

31 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

32 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)

33 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

13 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.[34] 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

34 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.[35] 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.[36] 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.[37]

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

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

36 ibid 34

37 ibid 34

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

Appendix 3 lists the ingredients authorized in the Czech Republic 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 57 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

14 Environmental Toxicity

110 ingredients authorized in the Czech Republic are classified as Dangerous for the Environment and 102 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-

38 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.[39] 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 13 because it effects human health as well as the environmental.

The summarised listings and categories of pesticide authorized in the Czech Republic 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.

14. 1 Classification of the European Union

14. 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.[40] The classification of dangerous substances regarding their environmental hazards can be found in the amendment paper 393L002131[41] (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 27 displays the classification and the applied risk phrases valid in the European Union. The tests, on which this evaluation is based, are described in Annex V of the Directive 67/548 EEC. Amendments and modifications to this Annex were added and they can be found in separate documents. Comments on the determination of certain effects can be looked up in Document 393L0021.

Table 27: 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

39 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

40 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

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, reg lations and administrative provisions relating to the classification, packaging and labelling of dangerous substance, Official Journal L 110, Brussels, Belgium

Table 27: 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	
-	-	-	-	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[42] 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 magna, 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[43] 17th amendment of Directive 67/548 EEC. Please note that the test method for fish from Document 398L0073 replaces the test method from Document 392L0069.

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

42 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

43 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

14. 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.[44]

14. 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.[45]

Since the health hazards of the pesticides authorized in the Czech Republic 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.

44 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

45 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

Low values mean low impact, high values the opposite. The parameter, the applied rating system and the main data sources are displayed in Table 28.

Table 28: Rating system for the Environmental Impact Quotient (EIQ)

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.[46] Potential endocrine disrupting effects have been left out in the model as well.

For 116 ingredients authorized in the Czech Republic the ecological impact according to the model of Cornell University has been calculated. The list of the ingredients authorized in the Czech Republic 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

15 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 the Czech Republic 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[47] 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,

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

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

Endrin, HCH etc.), PCB, moschus compounds and bromocycles. Food with plant origin is tested for pesticides, myco toxins, nitrate and plant surface treatment substances and heavy metals.

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

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

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

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

Groundwater

The Federal Working Group on Water (LAWA) collects data on water quality from all federal states and publishes them. The last report on pesticides in the groundwater was published in 1997 and contains data from the time span 1990 through 1995.[48] 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[49] (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

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

49 Only very few pesticides were tested, mostly organochlorines.

structure (biological activity, structure), precipitation and the environmental behaviour of the substance. Therefore, information on the concentration was neglected. Any residue reported to be found in groundwater was used in this study.

Surface Water

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

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

Appendix 5 lists 87 pesticides detected as residues in German food and water, which are authorized as pesticide in the Czech Republic.

15. 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[50]
- typically extract only 30-90% of the residues present,[51]
- do not cover all breakdown products,
- do not cover ‘inert’ ingredients,[52] and

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

51 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

52 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.

- may vary from year to year due to improved technologies, that can detect lower concentrations.

Actual pesticide use data are needed to develop targeted monitoring programme, and to evaluate pesticide use. In the US. States California and Oregon, any application of a pesticide with commercial intention has to be reported to governmental agencies. California use data have been used for a wide variety of purposes. A thorough analysis of the pesticide use reporting (PUR) systems in California and Oregon was published by PAN Germany in January 2002.[53] 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.[54] In the Czech Republic all professional users are required to keep detailed spray records. Farmers larger that 10ha submit information to the State Phytosanitary Administration. Collected data are published but are not widely used.

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

16 Summary

In opposition to other countries in transition agriculture in the Czech Republic is not characterised by small scale farming. Agriculture is recovering very fast from the political change and privatisation, and shows positive ecomonic results in the last years. The prospering agriculture goes hand in hand with increased pesticide usage. The plant growth regulator chlormequat-chloride and the herbicides glyphosate-IPA, alachlor, acetochlor are the top pesticides.

The Czech Republic is one of a very few countries globally, which maintain a permission system for the use of highly toxic or toxic pesticide products as well as a pesticide use reporting system. Unfortunately, pesticide use data are not used for the protection of human health and the environment.

Pesticide policy and authorisation will fully comply with EU regulation by the end of 2003.

In the year 2002 some 340 pesticide active ingredients, plant growth regulators and other substance used in crop protection were registered in the Czech Republic. The evaluation of these substances according to international classification system shows that:

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

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

- 131 of the ingredients authorized in the Czech Republic and evaluated are classified by the European Union: 12 as Very Toxic, 25 as Toxic, 70 as Harmful and 11 as Irritant;
- 19 of the ingredients authorized in the Czech Republic are cholinesterase inhibitors (ChE);
- 18 of the ingredients authorized in the Czech Republic are evaluated by the IARC: 7 as possibly carcinogenic to humans. 11 are considered as not classifiable as carcinogenic to humans;
- 14 of the ingredients authorized in the Czech Republic cause concern for humans due to possible carcinogenic effects and have been placed into the carcinogenicity category 3 by the EU. 7 cause concern for humans owing to possible mutagenic effects and have been placed into the mutagenicity category 3; 1 is placed into the mutagenicity category 2 and should be regarded as if it is mutagenic to humans; 4 may cause harm to the unborn child and 8 present possible risks of harm to the unborn child; and 4 pose the risk of impaired fertility;
- 110 ingredients authorized in the Czech Republic are classified as “Dangerous for the Environment” and 102 have been assigned with the Symbol “N;”
- 191 of the ingredients authorized in the Czech Republic are classified by the WHO: 4 as Extremely Hazardous, 7 as Highly Hazardous, 34 as Moderately Hazardous, 47 as Slightly Hazardous and 99as Unlikely to present hazard in normal use;
- 5 are PIC pesticides or PIC Canditates;
- 7 substances are priority substances according to the European Water Framework Directive.

With accession to the European Union in 2004 and in compliance with EU Directive 91/414 EC authorization for 38 active ingredients will expire in the Czech Republic.

Appendices

Appendix 1 - Identification and Regulatory Status

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
azocyclotin	41083-11-8	255-209-1	404	AC	Organotin	Notified		
clofentezine	74115-24-5		418	AC	Unclassified	Notified		
fenazaquin	120928-09-8	410-580-0		AC	Unclassified	Notified		
fenbutatin-oxide	13356-08-6	236-407-7	359	AC	Organotin	Notified		
fenpyroximate	111812-58-9			AC	Unclassified			
propargite	2312-35-8	219-006-1	216	AC	Unclassified	Notified		
tetradifon	116-29-0		113	AC	Bridged diphenyl	Out 7/03 essential		
dinocap	39300-45-3	254-408-0	98	AC, FU	Dinitrophenol derivative	pending		
triforine	26644-46-2		360	AC, FU	Unclassified	Out 7/03 essential		
acrinathrin	101007-06-1			AC, IN	Pyrethroid	Notified		
amitraz	33089-61-1	251-375-4	362	AC, IN	Formamidine	pending		
avermectin B1	65195-55-3			AC, IN	Microbial			
bifenthrin	82657-04-3		415	AC, IN	Pyrethroid	Notified		
diafenthiuron	80060-09-9			AC, IN	Unclassified	Out 7/03		
endosulfan	115-29-7	204-079-4	89	AC, IN	Organochlorine	pending		PD
flucycloxuron	113036-88-7		473	AC, IN	Benzoylurea	Out 7/03		
flufenoxuron	101463-69-8		470	AC, IN	Benzoylurea	Notified		
hexythiazox	78587-05-0	-	439	AC, IN	Unclassified	Notified		
lambda cyhalothrin	91465-08-6	415-130-7	463	AC, IN	Pyrethroid	Annex I		
permethrin	52645-53-1	258-067-9	331	AC, IN	Pyrethroid	out 12/03		
phosalone	2310-17-0	218-996-2	109	AC, IN	Organophosphorus	Dossier		
phosphamidon	13171-21-6	236-116-5	110	AC, IN	Organophosphorus	Out 7/03	Y	
pirimiphos-methyl	29232-93-7	249-528-5	239	AC, IN	Organophosphorus	Dossier		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
pyridaben	96489-71-3	405-700-3	583	AC, IN	Unclassified	Notified		
thiometon	640-15-3	211-362-6	115	AC, IN	Organophosphorus	Out 7/03		
calcium carbonate	471-34-1			AD	Inorganic	Out 7/03		
calcium hydroxide	1305-62-0			AD	Inorganic			
polyoxyethylated (6)decyl alcohol	61827-42-7			AD	Polyalkyloxy Compound			
polyoxyethylene sorbitan monooleate	9005-65-6			AD	Polyalkyloxy Compound			
boric acid	10043-35-3			BA, FU	Inorganic			
copper hydroxide	20427-59-2			BA, FU	Inorganic	Notified		
Amblyseius degenerans				beneficial organism	beneficial organism			
Amblyseius californicus				beneficial organism	beneficial organism			
Amblyseius cucumeris				beneficial organism	beneficial organism			
Aphidius colemani				beneficial organism	beneficial organism			
Aphidius ervi				beneficial organism	beneficial organism			
Aphidoletes aphidimyza				beneficial organism	beneficial organism			
Bacillus subtilis IBE 711				beneficial organism	beneficial organism			
Bacillus thuringiensis ssp. kurstaki				beneficial organism	beneficial organism			
Bacillus thuringiensis ssp. tenebrionis				beneficial organism	beneficial organism			

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
Baculovirus diprionis (SHDANOV)				beneficial organism	beneficial organism			
Borrelina reprimens HOLMES kmen HAMDEN				beneficial organism	beneficial organism			
Cryptilaemus montrouzieri				beneficial organism	beneficial organism			
Dacnusa sibirica				beneficial organism	beneficial organism			
Diglyphus isaea				beneficial organism	beneficial organism			
Encarsia formosa				beneficial organism	beneficial organism			
Eretmocerus eremicus				beneficial organism	beneficial organism			
Heterorhabditis megidis				beneficial organism	beneficial organism			
Hippodamia convergens				beneficial organism	beneficial organism			
Hypoaspis aculeifer				beneficial organism	beneficial organism			
Leptomastix dactylopii				beneficial organism	beneficial organism			
Macrolophus caliginosus				beneficial organism	beneficial organism			
Orius laevigatus				beneficial organism	beneficial organism			
Phytoseiulus persimilis				beneficial organism	beneficial organism			

	Chemical Identification					Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
Pythium oligandrum-oospory				beneficial organism	beneficial organism			
Steiernema feltiae				beneficial organism	beneficial organism			
Trichoderma harzianum Rifai agg. PV 5736-89				beneficial organism	beneficial organism			
Trichogramma evanescens				beneficial organism	beneficial organism			
Typhlodromus pyri				beneficial organism	beneficial organism			
8-hydroxyquinoline	148-24-3			FU	Unclassified			
azoxystrobin	131860-33-8	-	571	FU	Strobin	Annex I (new ai)		
benalaxyl	71626-11-4		416	FU	Xylylalanine	pending		
benomyl	17804-35-2	241-775-7	206	FU	Benzimidazole	out 05/03	Y	
bitertanol	55179-31-2		386	FU	Azole	Notified		
bromuconazole	116255-48-2			FU	Azole	Notified		
captan	133-06-2	205-087-0	40	FU	Thiophthalimide	Dossier		
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 (pentahydrate)	7758-99-8			FU	Inorganic			
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	Pyridine	Dossier		
dichlofluanid	1085-98-9	214-118-7	74	FU	Amide	Out 7/03		
difenoconazole	119446-68-3			FU	Azole	Notified		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
dimethomorph	110488-70-5	404-200-2	483	FU	Morpholine	Dossier		
dithianon	3347-22-6	222-098-6	153	FU	quinone	Notified		
dodine	2439-10-3	219-459-5	101	FU	Guanidine	Notified		
epoxiconazole	106325-08-0	406-850-2	609	FU	Conazole	Notified		
famoxadone	131807-57-3			FU	Oxazole	new ai, prov. authorization until 18.4.2004		
fenarimol	60168-88-9	262-095-7	380	FU	Pyrimidine	pending		
fenpiclonil	74738-17-3		519	FU	Unclassified	Out 7/03		
fenpropidin	67306-00-7		520	FU	Unclassified	Notified		
fenpropimorph	67564-91-4	266-719-9	427	FU	Morpholine	Notified		
fentin hydroxide	76-87-9	200-990-6	490	FU	Organotin	out 12/02		
fluazinam	79622-59-6		521	FU	2,6-Dinitroaniline	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	Dossier		
fosetyl-al	39148-24-8		384	FU	Unclassified	Dossier		
fuberidazole	3878-19-1	223-404-0	525	FU	Benzimidazole	Notified		
guazatine triacetate (mixture of acetates of guanidated di and tri-amines and oligomeric amines)	115044-19-4			FU	Guanidine			
imazalil	35554-44-0	252-615-0	335	FU	Azole	Annex I		
iprodione	36734-19-7	253-178-9	278	FU	Dicarboximide	Annex I		
kresoxim-methyl	143390-89-0	-	568	FU	Strobin	Annex I (new ai)		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
lecithin	8002-43-5			FU	Botanical			
mancozeb	8018-01-7	-	34	FU	Dithiocarbamate	pending		
metalaxyl	57837-19-1		365	FU	Xylylalanine	Out		
metalaxyl-M	70630-17-0	-		FU	Xylylalanine	new ai, prov. authoriza-tion until 18.4.2006		
metconazole	125116-23-6			FU	Azole	Dossier		
metiram	9006-42-2		478	FU	Dithiocarbamate	pending		
myclobutanil	88671-89-0	-	442	FU	Azole	Notified		
oxadixyl	77732-09-3		397	FU	Anilide	Out 7/03 essential		
oxycarboxin	5259-88-1	226-066-2	FU	FU	Carboxamide	Out 7/03 essential		
p-nitrophenol	100-02-7	202-811-7		FU	Phenols			
penconazole	66246-88-6		446	FU	Azole	Notified		
pencycuron	66063-05-6		402	FU	Urea	Notified		
phosphoric acid	7664-38-2	231-633-2		FU	Inorganic			
prochloraz	67747-09-5	266-994-5	407	FU	Azole	Notified		
prochloraz - manganese complex	75747-77-2			FU	Azole			
procymidone	32809-16-8		383	FU	Dicarboximide	pending		
propamocarb	24579-73-5		399	FU	Other Carbamate	Dossier		
propiconazole	60207-90-1		408	FU	Azole	pending		
pyrimethanil	53112-28-0			FU	Pyrimidine	Dossier		
quinoxyfen	124495-18-7	-		FU	Unclassified	new ai		
sodium bicarbonate	144-55-8			FU	Inorganic			

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
spiroxamine	118134-30-8	-		FU	Unclassified	Annex I (new ai)		
sulfur	7704-34-9		18	FU	Inorganic			
tebuconazole	107534-96-3		494	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		
thiram	137-26-8	205-286-2	24	FU	Dithiocarbamate	pending	Y	
tolclofos-methyl	57018-04-9		479	FU	Organophosphorus	Dossier		
tolylfluanid	731-27-1	211-986-9	275	FU	Amide	Dossier		
triadimefon	43121-43-3	256-103-8	352	FU	Azole	Notified		
triadimenol	55219-65-3		398	FU	Azole	Notified		
triazoxide	72459-58-6			FU	Unclassified	Notified		
tridemorph	24602-86-6	246-347-3	324	FU	Morpholine	Notified		
trifloxystrobin	141517-21-7			FU	Strobin	new ai		
triflumizole	68694-11-1			FU	Azole	Notified		
triticonazole	131983-72-7		652	FU	Azole	Dossier		
urea	57-13-6			FU	Inorganic			
vinclozolin	50471-44-8	256-599-6	280	FU	Dicarboximide	pending		
ziram	137-30-4	205-288-3	31	FU	Dithiocarbamate	pending		
Dazomet	533-74-4	208-576-7	146	FU, IN, NE, HB	Unclassified	Notified		
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		
acifluorfen	50594-66-6	256-634-5 [1]	497	HB	Diphenyl ether	Out 7/03 essential		
alachlor	15972-60-8	240-110-8	204	HB	Chloroacetanilide	pending		P

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
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	pending		PD
benazolin ethyl	25059-80-7	246-591-0		HB	Unclassified			
bentazon	25057-89-0	246-585-8	366	HB	Unclassified	Annex I		
bifenox	42576-02-3		413	HB	Diphenyl ether	Notified		
bromoxynil phenol	1689-84-5	216-882-7	87	HB	Hydroxybenzonitrile	pending		
carbetamide	16118-49-3		95	HB	Carbanilate	Notified		
carfentrazone-ethyl	128639-02-1	-		HB	Unclassified	new ai, prov. authoriza-tion until 12.3.2002		
chlorbromuron	13360-45-7		186	HB	Urea	Out 7/03		
chlorotoluron	15545-48-9		217	HB	Urea	pending		
chlorsulfuron	64902-72-3	265-268-5	391	HB	Sulfonylurea	Notified		
cinidon-ethyl	142891-20-1		598	HB	Unclassified	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	Dossier		
cyanazine	21725-46-2	244-544-9	230	HB	Triazine	Out 7/03 essential		
cycloxydim	101205-02-1		510	HB	Cyclohexenone derivative	Notified		
desmedipham	13684-56-5		477	HB	Bis-Carbamate	pending		
desmetryne	1014-69-3	213-800-1	147	HB	Triazine	Out 7/03		
dicamba	1918-00-9	217-635-6	85	HB	Benzoic acid	Notified		
dichlobenil	1194-65-6	214-787-5	73	HB	Substituted Benzene	Notified		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
dichlorprop-p	15165-67-0	403-980-1	476	HB	Chlorophenoxy acid or ester	Dossier		
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		HB	Chloroacetanilide	Notified		
dimethenamid	87674-68-8			HB	Amide	Dossier		
diquat dibromide	85-00-7	201-579-4	55	HB	Bipyridylium	Annex I		
ethofumesate	26225-79-6	247-525-3	233	HB	Unclassified	Annex I		
fenoxaprop-p-ethyl	71283-80-2			HB	Aryloxyphenoxy propionic acid			
ferrous sulfate heptahydrate	7782-63-0			HB	Inorganic			
florasulam	145701-23-1			HB	Triazolopyrimidine			
fluazifop-p-butyl	79241-46-6	-	467	HB	Aryloxyphenoxy propionic acid	Notified		
fluorochloridone	61213-25-0		430	HB	Unclassified	Notified		
fluoroglycofen-ethyl	77501-90-7			HB	Unclassified			
flupoxam	119126-15-7			HB	Amide	Out 7/03		
flupyrsulfuron	150315-10-9			HB	Sulfonylurea			
fluroxypyr	69377-81-7	-	431	HB	Pyridine	Annex I		
glufosinate-ammonium	77182-82-2	278-636-5	437	HB	Unclassified	Dossier		
glyphosate	1071-83-6	213-997-4	284	HB	Phosphonoglycine	Annex I		
glyphosate, isopropylamine salt	38641-94-0			HB	Phosphonoglycine			
glyphosate-trimesium	81591-81-3	-		HB	Phosphonoglycine			
haloxyfop-r	72619-32-0	406-250-0	526	HB	Aryloxyphenoxy propionic acid	Dossier		
hexazinone	51235-04-2	257-074-4	347	HB	Triazinone	Out 7/03 essential		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
imazamethabenz	81405-85-8		529	HB	Imidazolinone	Notified		
imazamox	114311-32-9			HB	Imidazolinone	new ai		
imazapyr	81334-34-1	-	530	HB	Imidazolinone	Out 7/03 essential		
imazethapyr	81335-77-5			HB	Imidazolinone	Notified		
iodosulfuron methyl, sodium salt	144550-36-7			HB	Sulfonylurea			
ioxynil	1689-83-4	216-881-1	86	HB	Hydroxybenzonitrile	pending		
ioxynil octanoate	3861-47-0	223-375-4		HB	Hydroxybenzonitrile			
isoproturon	34123-59-6	251-835-4	336	HB	Urea	Annex I		PD
isoxaflutole	141112-29-0	-		HB	Cyclopropylioxazole	new ai, prov. authoriza-tion until 18.4.2005		
lactofen	77501-63-4			HB	Diphenyl ether			
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		
MCPP	7085-19-0	202-264-4	51	HB	Chlorophenoxy acid or ester	pending		
mecoprop-P	16484-77-8		475	HB	Chlorophenoxy acid or ester	pending		
metamitron	41394-05-2	255-349-3	381	HB	Triazinone	Notified		
metazachlor	67129-08-2		411	HB	Chloroacetanilide	Notified		
metobromuron	3060-89-7		168	HB	Urea	Out 7/03 essential		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
metolachlor	51218-45-2		400	HB	Chloroacetanilide	Out 7/03		
metolachlor, (S)	87392-12-9			HB	Chloroacetanilide	new ai		
metosulam	139528-85-1			HB	Triazolopyrimidine	Notified		
metribuzin	21087-64-9	244-209-7	283	HB	Triazinone	Dossier		
monolinuron	1746-81-2	217-129-5	169	HB	Urea	out 9/01		
napropamide	15299-99-7		271	HB	Amide	Notified		
naptalam	132-66-1			HB	Amide	Out 7/03 essential		
nicosulfuron	111991-09-4			HB	Sulfonylurea	Notified		
oxadiazon	19666-30-9	243-215-7	213	HB	Unclassified	Notified		
oxyfluorfen	42874-03-3		538	HB	Diphenyl ether	Notified		
paraquat	4685-14-7			HB	Bipyridylium	pending		
pendimethalin	40487-42-1	254-938-2	357	HB	2,6-Dinitroaniline	Annex I		
phenmedipham	13684-63-4		77	HB	Bis-Carbamate	pending		
primisulfuron-methyl	86209-51-0			HB	Sulfonylurea	Notified		
prometryn	7287-19-6		93	HB	Triazine	Out 7/03 essential		
propachlor	1918-16-7	217-638-2	176	HB	Chloroacetanilide	Notified		
propaquizafop	111479-05-1			HB	Aryloxyphenoxy propionic acid	Notified		
propoxycarbazone	181274-15-7			HB	Triazolone			
propyzamide	23950-58-5	245-951-4	315	HB	Amide	pending		
prosulfuron	94125-34-5	-		HB	Sulfonylurea	new ai, prov. authoriza-tion until 18.4.2003		
pyrazon	1698-60-8	216-920-2	111	HB	Pyridazine	Notified		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
pyridate	55512-33-9	259-686-7	447	HB	Unclassified	Annex I		
quinmerac	90717-03-6		563	HB	Aromatic acid	Notified		
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			HB	Sulfonylurea	Dossier		
simazine	122-34-9	204-535-2	22	HB	Triazine	pending		PD
sulcotrione	99105-77-8			HB	Unclassified	Notified		
sulfosulfuron	141776-32-1			HB	Sulfonylurea	new ai		
terbuthylazine	5915-41-3		234	HB	Triazine	Notified		
terbutryn	886-50-0		212	HB	Triazine	Out 7/03 essential		
thifensulfuron-methyl	79277-27-3			HB	Sulfonylurea			
tralkoxydim	87820-88-0		544	HB	Cyclohexenone derivative	Notified		
triallate	2303-17-5	218-962-7	97	HB	Thiocarbamate	Notified		
triasulfuron	82097-50-5	-	480	HB	Sulfonylurea	Annex I		
tribenuron	106040-48-6			HB	Sulfonylurea			
tribenuron methyl	101200-48-0	401-190-1	546	HB	Sulfonylurea	Dossier		
triclopyr	55335-06-3		376	HB	Chloropyridinyl	Dossier		
trifluralin	1582-09-8	216-428-8	183	HB	2,6-Dinitroaniline	Dossier		PD
triflusulfuron-methyl	126535-15-7			HB	Sulfonylurea	Notified		
zinc	7440-66-6	231-175-3		HB	Inorganic			
methyl bromide	74-83-9	200-813-2	128	HB,AC,IN, NE,FU,RO	Halogenated organic	Notified		
acetamiprid	135410-20-7			IN	Chloro-nicotinyl	new ai		
bendiocarb	22781-23-3	245-216-8	232	IN	N-Methyl Carbamate	Out 7/03		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
benfuracarb	82560-54-1	-	501	IN	Other Carbamate	Dossier		
bensultap	17606-31-4	-	464	IN	Unclassified	Out 7/03		
bioresmethrin	28434-01-7	249-014-0	222	IN	Pyrethroid	Out 7/03		
borax	1303-96-4			IN	Inorganic			
buprofezin	69327-76-0			IN	Unclassified	Notified		
carbosulfan	55285-14-8	259-565-9	417	IN	N-Methyl Carbamate	Dossier		
chlorpyrifos	2921-88-2	220-864-4	221	IN	Organophosphorus	pending		PD
chlorpyrifos-methyl	5598-13-0		486	IN	Organophosphorus	pending		
cypermethrin (stereochemistry unspecified)	52315-07-8			IN	Pyrethroid	Notified		
cypermethrin, alpha	67375-30-8		454	IN	Pyrethroid	pending		
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	Dossier		
dicofol	115-32-2	204-082-0		IN	Organochlorine	Notified		
diflubenzuron	35367-38-5		339	IN	Benzoylurea	Notified		
dimethoate	60-51-5	200-480-3	59	IN	Organophosphorus	Dossier		
ethofenprox	80844-07-1		471	IN	Pyrethroid	Notified		
fenitrothion	122-14-5	204-524-2	35	IN	Organophosphorus	Dossier		
fenoxycarb	72490-01-8	276-696-7	425	IN	Other Carbamate	Notified		
fipronil	120068-37-3		581	IN	Pyrazole	Dossier		
furathiocarb	65907-30-4	265-974-3	434	IN	Thiocarbamate	Out 7/03 essential		
hexaflumuron	86479-06-3			IN	Benzoylurea	Notified		
imidacloprid	105827-78-9			IN	Chloro-nicotinyl	Notified		
lanolin	8006-54-0			IN	Pyridazine			
lufenuron	103055-07-8	410-690-9		IN	Benzoylurea	Notified		

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
methamidophos	10265-92-6	233-606-0	355	IN	Organophosphorus	pending	Y	
methidathion	950-37-8	213-449-4	193	IN	Organophosphorus	Out 07/03		
phorate	298-02-2	206-052-2	173	IN	Organophosphorus	Out 7/03		
pirimicarb	23103-98-2	245-430-1	231	IN	N-Methyl Carbamate	Dossier		
pymetrozine	123312-89-0			IN	Triazine	new ai		
pyrethrin i	121-21-1	204-455-8		IN	Pyrethroid			
pyrethrin ii	121-29-9	204-462-6		IN	Pyrethroid			
pyrethrin powder	8003-34-7	232-319-8	32	IN	Botanical			
tau-fluvalinate	102851-06-9		432	IN	Pyrethroid	Notified		
tebufenozide	112410-23-8	412-850-3		IN	Diacylhydrazine	Notified		
teflubenzuron	83121-18-0		450	IN	Benzoylurea	Notified		
tobacco extract				IN	Botanical			
triazamate	112143-82-5			IN	Unclassified	Dossier		
triflumuron	64628-44-0		548	IN	Benzoylurea	Notified		
carbofuran	1563-66-2	216-353-0	276	IN, NE	N-Methyl Carbamate	Dossier	Y	
hydrocyanic acid	74-90-8	200-821-6	incl 252	IN,RO	Inorganic			
phosphine	7803-51-2			IN,RO	Inorganic			
(-)-cis verbenol	18881-04-4			Insect Attractant	Pheromone			
cis-verbenol				Insect Attractant	Pheromone			
ipsdienol	35628-00-3			Insect Attractant	Pheromone			
lineatin	65035-34-9			Insect Attractant	Pheromone			
metaldehyde	9002-91-9			MO	Pyrazolylphenyl			
2-methoxy-5-nitrofenol Na (I)	636-93-1			not spec.	Unclassified			

Chemical Identification						Regulatory Status		
Substance	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
2-methoxypropan 1-ol	158-94-75			not spec.	Unclassified			
2-methyl-3-buten-2-ol	115-18-4			not spec.	Unclassified			
2-nitrofenol Na (l)	88-75-5			not spec.	Unclassified			
Aktivator				not spec.	Unclassified			
Anthranilic acid	118-92-3			not spec.	Unclassified			
Barvivo				not spec.	Unclassified			
chalcogran (2-ethyl-1,6-dioxaspiro (4,4) nonan)				not spec.	Unclassified			
di-1-menthene				not spec.	Unclassified			
hexamine	100-97-0	202-905-8		not spec.	Unclassified			
ichthammol	8029-68-3			not spec.	Unclassified			
mineral oil				not spec.	Petroleum derivative			
mineral oil SAE 10/95				not spec.	Petroleum derivative			
Molybdenum amonnia	12054-82-2			not spec.	Unclassified			
MON 4660 (AD-67)	71526-07-3			not spec.	Unclassified			
paraffine oil				not spec.	Petroleum derivative			
rape seed oil				not spec.	Plant oil			
rape seed oil methylester				not spec.	Plant oil ether			
titanium dioxide	13463-67-7			not spec.	Inorganic			
acibenzolar-s-methyl (CGA 245 704)	135158-54-2	420-050-0	597	PG	Unclassified			
chlormequat chloride	999-81-5	213-666-4	143	PG	Quaternary Ammonium Compound	Notified		
clodinafop-propargyl	105512-06-9			PG	Aryloxyphenoxy propionic acid			
daminozide	1596-84-5	216-485-9	330	PG	Unclassified	pending		
dimethipin	55290-64-7			PG	Unclassified	Notified		

Substance	Chemical Identification					Regulatory Status		
	CAS Number	EC Number	CIPAC	Use Type	Chemical Class	Directive 91/414	Water Directive	PIC
ethephon	16672-87-0	240-718-3	373	PG	Organophosphorus	Dossier		
hydrogen cyanamide	420-04-2	206-992-3		PG	Inorganic	Notified		
hymexazol	10004-44-1	233-000-6	528	PG	Oxazole	Notified		
IAA (indole-3-acetic acid)	87-51-4			PG	Auxin			
IBA (indole-3-butyric acid)	133-32-4			PG	Auxin			
lactic acid	598-82-3			PG	Unclassified			
maleic hydrazide	123-33-1		310	PG	Unclassified	Annex I		
NAA (1-naphthaleneacetic acid)	86-87-3		313	PG	Naphthalene acetic acid derivative			
calcium cyanamide	156-62-7	205-861-8	8048	PG, HB	Unclassified	Out 7/03		
chlorpropham	101-21-3		43	PG, HB	Other Carbamate	pending		
imazaquin	81335-37-7			PG, HB	Imidazolinone	Notified		
(-)-alpha-pinene	80-56-8			RE	Terpene			
pinolene				RE	Terpene			
methiocarb	2032-65-7	217-991-2	165	RE, MO	N-Methyl Carbamate	Dossier		
brodifacoum	56073-10-0	259-980-5	370	RO	Coumarin			
bromadiolone	28772-56-7		371	RO	Coumarin			
cloquintocet mexyl	99607-70-2			Safener	Unclassified	Not PPP		
dichlormid	37764-25-3			Safener	Unclassified	Not PPP		
mefenpyr-diethyl	135590-91-9			Safener	Unclassified			
methoxypropanol	107-98-2	203-539-1		Solvent	Alcohol/Ether			
POE-tridecylalcohol	9002-92-0			Solvent	Unclassified			
piperonyl butoxid	51-03-6			Synergist	Unclassified			

Appendix 2 - Human Toxicology of Pesticides Authorized in the Czech Republic

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

List of Abbreviations - Appendix 2

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

Acute Toxicity - World Health Organisation (WHO)

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

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

Classification of the EU

Symbol	Description
T+	Very toxic

T	Toxic
Xn	Harmful
Xi	Irritant

Several entries into the toxicity category define different toxicities for different exposure routes, the risk phrases 24-26/28 for instance means R24: Toxic in contact with skin and R26/28 Very toxic by inhalation and if swallowed.

The next list shows all risk phrases according to Directive 67/548. The risk phrases in the Appendix table also include environmental hazards (R50 - R56, R59) which are described in Appendix 4.

List of EC Risk Phrases to find in Appendix 2

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

Risk Phrase	Explanation
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.
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.

Risk Phrase	Explanation
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.
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.

Risk Phrase	Explanation
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.

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

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.

Category 1996-1999	Description
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.

Category 1999 to present	Description
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	WHO	EU Classification		Cancer Classification						ADI mg/kg/bw
				Symbol	Risk Phrase	EU	IARC	U.S EPA	EU Muta	EU Repro	ChE	
acrinathrin	101007-06-1	AC	U					D				
azocyclotin	41083-11-8	AC	II	T+	25-26-37/38-41-50/53							0,001
clofentezine	74115-24-5	AC	U					C				0,02
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
flucycloxuron	113036-88-7	AC	U									
propargite	2312-35-8	AC	III	Xn	22-36-50/53			B2				0,01
amitraz	33089-61-1	AC,IN	III	Xn	22			C				0,01
hexythiazox	78587-05-0	AC,IN	U		50/53			C				0,03
pyridaben	96489-71-3	AC,IN	III	T	23/25-50/53			E				
tetradifon	116-29-0	AC,IN	U									
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				
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									

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	
carfentrazone-ethyl	128639-02-1	FU			50/53							
chlorothalonil	1897-45-6	FU	U	Xn	40-50/53	3	2B	Likely				0,03
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
difenoconazole	119446-68-3	FU	III					C				
dimethomorph	110488-70-5	FU	U		51/53							
dithianon	3347-22-6	FU	III	Xn	22-50/53							0,01
dodine	2439-10-3	FU	III	Xn	22-36/38-50/53							
epoxiconazole	106325-08-0	FU		T	61-40-62-51/53	3				2; 3		
famoxadone	131807-57-3	FU	U									
fenarimol	60168-88-9	FU	U	Xn	51/53-62-63-64			E		3		0,01
fenpiclonil	74738-17-3	FU	U									
fenpropidin	67306-00-7	FU	II									
fenpropimorph	67564-91-4	FU	U	Xn	20-38-51/53							
fluazinam	79622-59-6	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		Deferred		2		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	
flutriafol	76674-21-0	FU	III									
folpet	133-07-3	FU	U	Xn	20-36-40-43-50	3		B2				0,1
fosetyl-al	39148-24-8	FU						Not amenable to classification				
fuberidazole	3878-19-1	FU	II	Xn	22-50/53							
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
kresoxim-methyl	143390-89-0	FU		Xn	40-50/53	3		Likely to be carcinogenic to humans				
mancozeb	8018-01-7	FU	U	Xi	37-43			B2				0,03
metalaxyl	57837-19-1	FU	III					E				0,03
metalaxyl-m	70630-17-0	FU		Xn	22-41							
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
oxadixyl	77732-09-3	FU	III					C				
oxycarboxin	5259-88-1	FU	U	Xn	22-52/53							

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
penconazole	66246-88-6	FU	U									0,03
pencycuron	66063-05-6	FU	U									
prochloraz	67747-09-5	FU	III	Xn	22-50/53			C				0,01
prochloraz - manganese complex	75747-77-2	FU										
procymidone	32809-16-8	FU	U					B2				0,1
propamocarb	24579-73-5	FU	U									0,1
propamocarb	24579-73-5	FU	U									0,1
propiconazole	60207-90-1	FU	II					C				0,04
pyrimethanil	53112-28-0	FU	U					C				
quinoxyfen	124495-18-7	FU	U	Xi	43-50/53							
spiroxamine	118134-30-8	FU	II	Xn	20/21/22-38-43-50/53							
tebuconazole	107534-96-3	FU	III					C				0,03
thiabendazole	148-79-8	FU	U		50/53			Likely to be carcinogenic to humans				0,1
thiophanate-methyl	23564-05-8	FU	U	Xn	20-43-50/53-68			Likely to be carcinogenic to humans	3			0,02
thiram	137-26-8	FU	III	Xn	20/22-36/37-68-43		3		3			0,01

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	
tolclofos-methyl	57018-04-9	FU	U								Yes	0,07
triadimefon	43121-43-3	FU	III	Xn	22-51/53			C				0,03
triadimenol	55219-65-3	FU	III					C				0,05
triazoxide	72459-58-6	FU										
tridemorph	24602-86-6	FU		T	61-20/22-38-50/53					2		
trifloxystrobin	141517-21-7	FU										
triflumizole	68694-11-1	FU						E				
triticonazole	131983-72-7	FU	U									
vinclozolin	50471-44-8	FU	U	T	60-61-40-43-51/53	3		C		2		0,01
dinocap	39300-45-3	FU,AC	III	Xn	22-38			E				0,008
tolylfluanid	731-27-1	FU,AC	U	T	23-36/37/38-43-48/ 20-50/53							0,1
triforine	26644-46-2	FU,AC	U									
fentin hydroxide	76-87-9	FU,HB	II	T+	24/25-26-37/38-40-41-48/23-50/53-63	3		B2		3		0,0005
methyl bromide	74-83-9	FU,IN, NE,HB	FUM	T	23/25-36/37/38-68-48/20-50-59		3	D	2			1
ziram	137-30-4	FU,RE	III	Xn	22-36/37/38-68		3	Likely to be carci-nogenic to humans	3			0,02
acetochlor	34256-82-1	HB	III	Xn	20-37/38-43-50/53			B2				

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
acifluorfen	50594-66-6	HB	III	Xn	22-38-41-50/53							
alachlor	15972-60-8	HB	III	Xn	22-40-43-50/53	3		Likely (high doses) Not likely (low doses)				
amidosulfuron	120923-37-7	HB										
asulam	3337-71-1	HB	U					C				
atrazine	1912-24-9	HB	U	Xn	43-48/22-50/53		3	C				0,0007
bentazone	25057-89-0	HB	III	Xn	22-36-43-52/53			E				0,1
bifenox	42576-02-3	HB	U									
bromoxynil phenol	1689-84-5	HB	II	T	25-63			C		3		
carbetamide	16118-49-3	HB	U									
chlorbromuron	13360-45-7	HB	U									
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				

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	
cycloxydim	101205-02-1	HB	U									0,07
desmedipham	13684-56-5	HB	U					E				
desmetryne	1014-69-3	HB	III	Xn	21/22-50/53							
dicamba	1918-00-9	HB	III	Xn	22-41-52/53			D				
dichlobenil	1194-65-6	HB	U	Xn	21-51/53			C				
dichlorprop-p	15165-67-0	HB		Xn	22-38-41-43		2B					
diflufenican	83164-33-4	HB	U		52/53							
dimefuron	34205-21-5	HB	U									
dimethachlor	50563-36-5	HB	III	Xn	22-43-50/53							
dimethenamid	87674-68-8	HB						C				
diquat dibromide	85-00-7	HB		T+	22-26-36/37/38-43-48/25-50/53			E				
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		
fluorochloridone	61213-25-0	HB	U									
flupoxam	119126-15-7	HB										
flupyrsulfuron	150315-10-9	HB										
fluroxypyr	69377-81-7	HB	U		52/53			Not Likely				

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
glufosinate-ammonium	77182-82-2	HB		Xn	22							
glyphosate	1071-83-6	HB	U	Xi	41-51/53			E				0,3
glyphosate, isopropylamine salt	38641-94-0	HB										
glyphosate-trimesium	81591-81-3	HB		Xn	22-51/53			E				
guazatine triacetate	115044-19-4	HB										
haloxyfop-r	72619-32-0	HB		Xn	22-50/53							
hexazinone	51235-04-2	HB	III	Xn	22-36-50/53			D				
imazamethabenz	81405-85-8	HB	U					D				
imazamox	114311-32-9	HB						Not Likely				
imazapyr	81334-34-1	HB	U	Xi	36-52/53			E				
iodosulfuron methyl, sodium salt	144550-36-7	HB										
ioxynil	1689-83-4	HB	II	T	21-25-50/53-63					3		
ioxynil octanoate	3861-47-0	HB	II	Xn	22-50/53-63					3		
isoproturon	34123-59-6	HB	III	Xn	22-40-50/53	3						
isoxaflutole	141112-29-0	HB		Xn	50/53-63					3		
lactofen	77501-63-4	HB						B2				
lenacil	2164-08-1	HB	U									
linuron	330-55-2	HB	U	Xn	22-40-48/22-50/53	3		C				

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				
MCPA	94-74-6	HB	III	Xn	22-38-41		2B					
MCPB	94-81-5	HB	III	Xn	22		2B					
MCPP (mecoprop)	7085-19-0	HB	III	Xn	22-38-41		2B					
mecoprop-P	16484-77-8	HB	III				2B					
metazachlor	67129-08-2	HB	U									
metobromuron	3060-89-7	HB	U									
metolachlor	51218-45-2	HB	III					C				0,0015
metolachlor, (S)	87392-12-9	HB										
metosulam	139528-85-1	HB	U									
metribuzin	21087-64-9	HB	II	Xn	22-50/53			D				
monolinuron	1746-81-2	HB	U	Xn	22-48/22-50/53							
napropamide	15299-99-7	HB	U									
naptalam	132-66-1	HB	U					D				
nicosulfuron	111991-09-4	HB	U					E				
oxyfluorfen	42874-03-3	HB	U					C				
paraquat	4685-14-7	HB										0,004
pendimethalin	40487-42-1	HB	III	Xi	43-50/53			C				0,005
phenmedipham	13684-63-4	HB	U					D				
primisulfuron-methyl	86209-51-0	HB						D				
prometryn	7287-19-6	HB	U					E				

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
propachlor	1918-16-7	HB	III	Xn	22-36-43-50/53			Likely				
propaquizafop	111479-05-1	HB	U									
propoxycarbazone	181274-15-7	HB										
propyzamide	23950-58-5	HB	U	Xn	40-50/53	3		B2				
prosulfuron	94125-34-5	HB		Xn	22-50/53			D				
pyrazon	1698-60-8	HB	U	Xi	43-50/53							
pyridate	55512-33-9	HB	III	Xi	38-43-50/53							
quinmerac	90717-03-6	HB	U									
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				
simazine	122-34-9	HB	U	Xn	40-50/53	3	3	C				
sulcotrione	99105-77-8	HB										
sulfosulfuron	141776-32-1	HB						Likely				
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				
triallate	2303-17-5	HB	III	Xn	22-43-48/22-50/53			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	
triasulfuron	82097-50-5	HB	U		50/53			E				
tribenuron	106040-48-6	HB	U									
tribenuron methyl	101200-48-0	HB		Xi	43			C				
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				
metamitron	41394-05-2	HB	III	Xn	22-50/53							
clodinafop-propargyl	105512-06-9	HB, PG						Likely to be carci-nogenic to humans				
2,4-D	94-75-7	HB,PG	II	Xn	22-37-41-43-52/53		2B	D				0,3
imazethapyr	81335-77-5	HB,PG	U									
acetamiprid	135410-20-7	IN										
avermectin B1	65195-55-3	IN						E				
bendiocarb	22781-23-3	IN	II	T	21-23/25-50/53			Not Likely			Yes	0,004
bensultap	17606-31-4	IN	III	Xn	22-50/53							
bioresmethrin	28434-01-7	IN	U		50/53							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	
buprofezin	69327-76-0	IN	U					Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential				0,01
cypermethrin (stereochemistry unspecified)	52315-07-8	IN	Ib					C				0,05
cypermethrin, alpha	67375-30-8	IN	II									
cyromazine	66215-27-8	IN	U					E				0,02
deltamethrin	52918-63-5	IN	II	T	23/25-50/53		3					0,01
dicofol	115-32-2	IN	III	Xn	21/22-38-43-50/53		3	C				0,002
diflubenzuron	35367-38-5	IN	U					E				0,02
ethofenprox	80844-07-1	IN	U					C				0,03
fenoxycarb	72490-01-8	IN	U		50/53			B2				
fipronil	120068-37-3	IN	II					C				0,0002
flufenoxuron	101463-69-8	IN	U									

Chemical	CAS Number	Use Type	EU Classification			Cancer Classification						ADI mg/kg/bw
			WHO	Symbol	Risk Phrase	EU	IARC	U.S EPA	EU Muta	EU Repro	ChE	
furathiocarb	65907-30-4	IN	Ib	T+	25-26-36/38-43-48/ 22-50/53							
hexaflumuron	86479-06-3	IN	U									
imidacloprid	105827-78-9	IN						E				
lambda cyhalothrin	91465-08-6	IN	II	T+	21-25-26-50/53							
lufenuron	103055-07-8	IN		Xi	43-50/53							
permethrin	52645-53-1	IN	II	Xn	22		3	C				0,05
phorate	298-02-2	IN	Ia	T+	27/28			E			Yes	0,0005
pirimicarb	23103-98-2	IN	II	T	25-50/53						Yes	0,02
pirimiphos-methyl	29232-93-7	IN	III	Xn	22			Can not be deter-mined			Yes	0,03
pymetrozine	123312-89-0	IN						Likely to be carci-nogenic to humans				
pyrethrin I	121-21-1	IN		Xn	20/21/22-50/52							
pyrethrin II	121-29-9	IN		Xn	20/21/22-50/53							
tau-fluvalinate	102851-06-9	IN	U	Xn	22-38-50/53							
tebufenozide	112410-23-8	IN			51/53			E				
teflubenzuron	83121-18-0	IN	U									0,01
triazamate	112143-82-5	IN	II									

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
triflumuron	64628-44-0	IN	U									
bifenthrin	82657-04-3	IN,AC	II					C				0,02
chlorpyrifos	2921-88-2	IN,AC	II	T	24/25-50/53			E			Yes	0,01
chlorpyrifos-methyl	5598-13-0	IN,AC	U								Yes	0,01
diafenthiuron	80060-09-9	IN,AC	U									
diazinon	333-41-5	IN,AC	II	Xn	22-50/53			Not Likely			Yes	0,002
dimethoate	60-51-5	IN,AC	II	Xn	21/22			C			Yes	0,002
endosulfan	115-29-7	IN,AC	II	T	24/25-36-50/53			E				0,006
fenitrothion	122-14-5	IN,AC	II	Xn	22-50/53			E			Yes	0,005
methamidophos	10265-92-6	IN,AC	Ib	T+	24-28-36-50			E			Yes	0,004
methidathion	950-37-8	IN,AC	Ib	T+	21-28-50/53			C			Yes	0,001
phosalone	2310-17-0	IN,AC	II	T	21-25-50/53						Yes	0,02
phosphamidon	13171-21-6	IN,AC	Ia	T+	24-28-68-50/53			C	3		Yes	0,0005
thiometon	640-15-3	IN,AC	Ib	T	21-25						Yes	0,003
methiocarb	2032-65-7	IN,MO, RE	Ib	T	25-50/53			D			Yes	0,02
benfuracarb	82560-54-1	IN,NE	II	T	23/25-50/53							
carbosulfan	55285-14-8	IN,NE	II	T	23/25-43-50/53						Yes	0,01
carbofuran	1563-66-2	IN,NE, AC	Ib	T+	26/28-50/53			Not Likely			Yes	0,01
metaldehyde	9002-91-9	MO										

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	
dazomet	533-74-4	NE,FU, HB,ST	III	Xn	22-36-50/53			D				
imazaquin	81335-37-7	PG	U									
chlorpropham	101-21-3	PG,HB	U				3	E				0,03
dimethipin	55290-64-7	PG,HB	III					C				0,02
hydrogen cyanamide	420-04-2	PG,HB		T	21-25-36/38-43			C				
brodifacoum	56073-10-0	RO	Ia	T+	27/28-48/24/25-50/53							
bromadiolone	28772-56-7	RO	Ia									

Appendix 3 - Ingredients Authorized in the Czech Republic 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**
2,4-D	HB,PG		Yes	P	Yes	x	2	Not pers	
acetochlor	HB	Thyroid				x	1	Not pers	High
alachlor	HB	Thyroid	Yes	P	Yes	x	1	Not pers	High
amitraz	AC,IN					x		Not pers	
atrazine	HB	Neuroendocrine-pituitary	Yes	K	Yes	x	1	Pers	High
benomyl	FU		Yes	Probable	Yes	x		Not pers	
bifenthrin	IN,AC					x		Pers	
bromoxynil	HB					x		Not pers	
carbendazim	FU					x	2	Not pers	
carbofuran	IN,NE,AC					x		Not pers	
chlorpyrifos	IN,AC		Yes		Yes	x		Not pers	
clofentezine	AC	Thyroid				x		Not pers	
cyanazine	HB		Yes			x		Not pers	
cypermethrin	IN	Disruption of reproductive function	Yes	S	Yes	x		Not pers	

						European Union			
Chemical	**Use Type**	**Colborn**	**Benbrook**	**EPA Illinois**	**Keith**	**EU Review.**	**EU ED Cat.**	**Persist.**	**Exposure Concern**
deltamethrin	IN					x		Not pers	
diazinon	IN,AC					x	2	Not pers	
dicofol	IN,AC	Estrogen	Yes	K	Yes	x	2	Pers	
difenoconazole	FU					x		Pers	
diflubenzuron	IN					x		Pers	
dimethoat	IN,AC	Estrogen				x	2	Not pers	
endosulfan	IN,AC	Estrogen	Yes	K	Yes	x	2	Pers+	
etofenprox	IN					x		Not pers	
fenarimol	FU	Estrogen				x		Pers	
fentin-hydroxide	FU,HB		Yes						
fipronil	IN	Thyroid							
flutriafol	FU					x		Pers	
ioxynil	HB					x		Not pers	
iprodione	FU	Inhibition of testosterone synthesis				x	2	Not pers	
lambda-cyhalothrin	IN	Thyroid				x		Not pers	
linuron	HB	Androgen				x	1	Not pers	High
mancozeb	FU	Thyroid	Yes	P	Yes				
methyl bromide	FU,IN, NE,HB					x	2	Not pers	
metiram	FU			P	Yes	x		Not pers	
metolachlor	HB				Yes				
metribuzin	HB	Thyroid	Yes	S	Yes	x		Not pers	
myclobutanil	FU					x		Not pers	
paraquat	HB					x	3 B*	Not pers	
penconazole	FU					x		Not pers	
pendimethalin	HB	Thyroid				x		Pers	
permethrin	IN	Estrogenic	Yes	S		x		Not pers	

Chemical	Use Type	Colborn	Benbrook	EPA Illinois	Keith	European Union EU Review.	EU ED Cat.	Persist.	Exposure Concern
phosphamidon	IN,AC					x		Not pers	
prochloraz	FU					x	2	Not pers	
procymidone	FU	Androgen				x		Pers	
prometryn	HB					x		Not pers	
propiconazole	FU					x		Pers	
propyzamide	HB					x		Not pers	
pyrimethanil	FU	Thyroid							
s-metolachlor	IN				Yes				
simazine	HB				Yes	x	2	Not pers	
terbutryn	HB					x		Pers	
thiram	FU	Neuroendo-crine-pituitary				x	1	Not pers	High
triadimefon	FU	Estrogen				x	2	Not pers	
triadimenol	FU	Estrogen							
trifluralin	HB	Reproductive/ Metabolic	Yes	P	Yes	x		Pers	
vinclozolin	FU	Androgen	Yes	P	Yes	x	1	Pers	High
zeta-cyper-methrin	IN	Disruption of reproductive function	Yes	S	Yes	x		Not pers	
ziram	FU,RE	Thyroid	Yes	S	Yes	x	2	Not pers	

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 the Czech Republic

Appendix 4 presents the environmental toxicity of the pesticides authorized in the Czech Republic 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
acrinathrin	101007-06-1	AC									
azocyclotin	41083-11-8	AC	N	50/53							
clofentezine	74115-24-5	AC			4	16,1	9	9	52,8	1	86,9
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
flucycloxuron	113036-88-7	AC									
propargite	2312-35-8	AC	N	50/53	6	25	9	9	39,2	1	82,2
amitraz	33089-61-1	AC, IN			6,5	3	9	3	18,2	3	33,2
hexythiazox	78587-05-0	AC, IN	N	50/53	6	25	9	9	52,8	1	95,8
pyridaben	96489-71-3	AC, IN	N	50/53	3,1	16,1	6,2	46,5	54,6	1	123,3
tetradifon	116-29-0	AC, IN									
azoxystrobin	131860-33-8	FU	N	50/53	5	15	6	3	12,6	3	36,6
benalaxyl	71626-11-4	FU									
benomyl	17804-35-2	FU			50	25	15	15	73,5	5	128,5
bitertanol	55179-31-2	FU									
bromuconazole	116255-48-2	FU									
captan	133-06-2	FU	N	50	8	5	6	9	29,9	1	49,9
carbendazim	10605-21-7	FU									
carboxin	5234-68-4	FU			5,5	15	15	3	12,4	1	45,4
carfentrazone-ethyl	128639-02-1	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
chlorothalonil	1897-45-6	FU	N	50/53	11	25	12	15	50	1	102
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
dithianon	3347-22-6	FU	N	50/53							
dodine	2439-10-3	FU	N	50/53	16,4	15	9,2	9,3	34,4	1	67,9
epoxiconazole	106325-08-0	FU	N	51/53							
famoxadone	131807-57-3	FU									
fenarimol	60168-88-9	FU	N	51/53	23	25	9	3	10	5	47
fenpiclonil	74738-17-3	FU									
fenpropidin	67306-00-7	FU									
fenpropimorph	67564-91-4	FU	N	51/53							
fluazinam	79622-59-6	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							

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
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
kresoxim-methyl	143390-89-0	FU	N	50/53							
mancozeb	8018-01-7	FU			17	25	12	15	78	1	130
metalaxyl	57837-19-1	FU			11	1	6	9	52,5	5	68,5
metalaxyl-m	70630-17-0	FU									
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
oxadixyl	77732-09-3	FU									
oxycarboxin	5259-88-1	FU		52/53							
penconazole	66246-88-6	FU									
pencycuron	66063-05-6	FU									
prochloraz	67747-09-5	FU	N	50/53							
prochloraz - mn complex	75747-77-2	FU									
procymidone	32809-16-8	FU									
propamocarb	24579-73-5	FU			3	3	3	3,3	25	1	34,3
propiconazole	60207-90-1	FU			14,6	3	9,1	9,1	30,6	1	51,7
pyrimethanil	53112-28-0	FU									
quinoxyfen	124495-18-7	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
spiroxamine	118134-30-8	FU	N	50/53							
tebuconazole	107534-96-3	FU									
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
thiram	137-26-8	FU			7,2	15	18,5	9,3	40,8	1	83,5
tolclofos-methyl	57018-04-9	FU									
triadimefon	43121-43-3	FU	N	51/53	4	15	6	3	17	1	41
triadimenol	55219-65-3	FU			10	9	9	9	35	3	62
triazoxide	72459-58-6	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
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
dinocap	39300-45-3	FU, AC			12	15	3	3	15,9	1	36,9
tolylfluanid	731-27-1	FU, AC	N	50/53							
triforine	26644-46-2	FU, AC			25,9	13,7	12,2	9,3	38,3	1,6	73,4
fentin hydroxide	76-87-9	FU, HB	N	50/53	5	18	12	9	30	1	69
methyl bromide	74-83-9	FU, IN, NE, HB	N	50-59							
ziram	137-30-4	FU, RE			13,2	3	24,3	9,3	31	1	67,6
acetochlor	34256-82-1	HB	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
acifluorfen	50594-66-6	HB	N	50/53	12	3	9	9	51	3	72
alachlor	15972-60-8	HB	N	50/53	6	9	3	3	25	3	40
amidosulfuron	120923-37-7	HB									
asulam	3337-71-1	HB									
atrazine	1912-24-9	HB	N	50/53	9,5	9	9	9	51	5	78
bentazone	25057-89-0	HB		52/53	11	3	18	9	51	5	81
bifenox	42576-02-3	HB									
bromoxynil	1689-84-5	HB			4,8	15	17,1	3	17	1	52,1
carbetamide	16118-49-3	HB									
chlorbromuron	13360-45-7	HB									
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
cycloxydim	101205-02-1	HB									
desmedipham	13684-56-5	HB									
desmetryne	1014-69-3	HB	N	50/53							
dicamba	1918-00-9	HB		52/53	8	1	6	9	30	5	46
dichlobenil	1194-65-6	HB	N	51/53	7	3	6	3	17	5	29

Pesticide	CAS Number	Use Type	European Union[a]		Evaluation Cornell University (New York)						
			Symbol	Risk Phrases	Fish	Birds	Bees	Beneficial Organism	Groundwater and Runoff Potential	Terrestrial Organisms	Ecological Impact
dichlorprop-P	15165-67-0	HB									
diflufenican	83164-33-4	HB		52/53							
dimefuron	34205-21-5	HB									
dimethachlor	50563-36-5	HB	N	50/53							
dimethenamid	87674-68-8	HB			7,7	10,2	7,4	6,4	35,9	3	59,9
diquat dibromide	85-00-7	HB	N	50/53	7	5	27	3	17	1	52
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							
fluorochloridone	61213-25-0	HB									
flupoxam	119126-15-7	HB									
flupyrsulfuron	150315-10-9	HB									
fluroxypyr	69377-81-7	HB		52/53							
glufosinate-ammonium	77182-82-2	HB			7,3	3	4,7	6,4	35,9	5	50
glyphosate	1071-83-6	HB	N	51/53	7	15	9	9	41,3	1	74,3
glyphosate-IPA	38641-94-0	HB									
glyphosate-trimesium	81591-81-3	HB	N	51/53							
guazatin-acetate (GTA)	115044-19-4	HB									
haloxyfop-R	72619-32-0	HB	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
hexazinone	51235-04-2	HB	N	50/53							
imazamethabenz	81405-85-8	HB									
imazamox	114311-32-9	HB									
imazapyr	81334-34-1	HB		52/53	10	2,1	9	3	17	5	31,1
iodosulfuron methyl, sodium salt	144550-36-7	HB									
ioxynil	1689-83-4	HB	N	50/53							
ioxynil octanoate	3861-47-0	HB	N	50/53							
isoproturon	34123-59-6	HB	N	50/53							
isoxaflutole	141112-29-0	HB	N	50/53							
lactofen	77501-63-4	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									
MCPP (mecoprop)	7085-19-0	HB									
mecoprop-P	16484-77-8	HB			9,7	1	6	9	50,9	5	66,9
metazachlor	67129-08-2	HB									
metobromuron	3060-89-7	HB									
metolachlor	51218-45-2	HB			7	9	6	3	17	3	35
metolachlor, (S)	87392-12-9	HB									
metosulam	139528-85-1	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
metribuzin	21087-64-9	HB	N	50/53	8	3	27	9	51	5	90
monolinuron	1746-81-2	HB	N	50/53							
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
oxyfluorfen	42874-03-3	HB			8,5	25	27	9	51	1	112
paraquat	4685-14-7	HB			13	15	36	9	65	1	125
pendimethalin	40487-42-1	HB	N	50/53	8,5	25	9	3	17	1	54
phenmedipham	13684-63-4	HB			5,5	10,5	13,5	9	40,1	1	73,1
primisulfuron-methyl	86209-51-0	HB									
prometryn	7287-19-6	HB									
propachlor	1918-16-7	HB	N	50/53							
propaquizafop	111479-05-1	HB									
propoxycarbazone	181274-15-7	HB									
propyzamide	23950-58-5	HB	N	50/53	10	5	9	9	51	1	74
prosulfuron	94125-34-5	HB	N	50/53	8,7	1	7,4	6,4	35,9	5	50,7
pyrazon	1698-60-8	HB	N	50/53	7	3	9	3	20	5	35
pyridate	55512-33-9	HB	N	50/53	3	10,8	6	9	51	1	76,8
quinmerac	90717-03-6	HB									
quizalofop-P-ethyl	100646-51-3	HB									
quizalofop-P-tefuryl	119738-06-6	HB	N	50/53							
rimsulfuron	122931-48-0	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
simazine	122-34-9	HB	N	50/53	9	3	6	3	14,2	5	26,2
sulcotrione	99105-77-8	HB									
sulfosulfuron	141776-32-1	HB									
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									
triallate	2303-17-5	HB	N	50/53							
triasulfuron	82097-50-5	HB	N	50/53							
tribenuron	106040-48-6	HB									
tribenuron methyl	101200-48-0	HB									
triclopyr	55335-06-3	HB			9,5	3	9	9	51	5	72
trifluralin	1582-09-8	HB	N	50/53	8,5	25	9	3	20	1	57
triflusulfuron-methyl	126535-15-7	HB									
metamitron	41394-05-2	HB	N	50/53							
2,4-d	94-75-7	HB, PG		52/53	7	3	18	9	60	1	90
clodinafop-propargyl	105512-06-9	HB, PG									
imazethapyr	81335-77-5	HB, PG			7	1	6	9	50,9	5	66,9
acetamiprid	135410-20-7	IN									
avermectin b1	65195-55-3	IN									
bendiocarb	22781-23-3	IN	N	50/53	3,8	9,6	5	15	17,5	2,1	47,1
bensultap	17606-31-4	IN	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
bioresmethrin	28434-01-7	IN	N	50/53							
buprofezin	69327-76-0	IN									
cypermethrin (stereochemistry unspecified)	52315-07-8	IN									
cypermethrin, alpha	67375-30-8	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
dicofol	115-32-2	IN	N	50/53	5	25	6	3	14,6	1	48,6
diflubenzuron	35367-38-5	IN			5,5	5	9	15	69	1	98
ethofenprox	80844-07-1	IN									
fenoxycarb	72490-01-8	IN	N	50/53							
fipronil	120068-37-3	IN			7,1	16,1	36,8	6,3	33,6	1	92,8
flufenoxuron	101463-69-8	IN									
furathiocarb	65907-30-4	IN	N	50/53							
hexaflumuron	86479-06-3	IN									
imidacloprid	105827-78-9	IN			19	1	12	45	22,5	1	80,5
lambda cyhalothrin	91465-08-6	IN	N	50/53	2,7	25	3	15	17,5	1	60,5
lufenuron	103055-07-8	IN	N	50/53							
permethrin	52645-53-1	IN			8,5	25	9	45	61,8	1	140,8
phorate	298-02-2	IN			10	25	45	27	57,6	1	154,6
pirimicarb	23103-98-2	IN	N	50/53	11,4	3,2	24,8	3	15	2	45,9

Pesticide	CAS Number	Use Type	European Union[a]		Evaluation Cornell University (New York)						
			Symbol	Risk Phrases	Fish	Birds	Bees	Beneficial Organism	Groundwater and Runoff Potential	Terrestrial Organisms	Ecological Impact
pirimiphos-methyl	29232-93-7	IN									
pymetrozine	123312-89-0	IN									
pyrethrin I	121-21-1	IN	N	50/52							
pyrethrin II	121-29-9	IN	N	50/53							
tau-fluvalinate	102851-06-9	IN	N	50/53							
tebufenozide	112410-23-8	IN	N	51/53	14	9	11	15	88	3	123
teflubenzuron	83121-18-0	IN									
triazamate	112143-82-5	IN									
triflumuron	64628-44-0	IN									
bifenthrin	82657-04-3	IN, AC			8,3	16	6,3	18,5	38,1	2	78,9
chlorpyrifos	2921-88-2	IN, AC	N	50/53	8,5	25	45	15	19,9	1	104,9
chlorpyrifos-methyl	5598-13-0	IN, AC									
diafenthiuron	80060-09-9	IN, AC									
diazinon	333-41-5	IN, AC	N	50/53	8	15	30	15	19,5	3	79,5
dimethoate	60-51-5	IN, AC			9	5	30	45	60,9	3	140,9
endosulfan	115-29-7	IN, AC	N	50/53	7	25	27	9	17,6	1	78,6
fenitrothion	122-14-5	IN, AC	N	50/53	5	3	15	15	20,5	3	53,5
methamidophos	10265-92-6	IN, AC	N	50	11	1	30	45	65,3	5	141,3
methidathion	950-37-8	IN, AC	N	50/53	8	15	18	45	61,8	3	139,8
phosalone	2310-17-0	IN, AC	N	50/53	3,6	16,1	3	3	17,4	2	39,5
phosphamidon	13171-21-6	IN, AC	N	50/53	8	3	15	15	19,9	5	52,9
thiometon	640-15-3	IN, AC									

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
methiocarb	2032-65-7	IN, MO, RE	N	50/53							
benfuracarb	82560-54-1	IN, NE	N	50/53							
carbosulfan	55285-14-8	IN, NE	N	50/53							
carbofuran	1563-66-2	IN, NE, AC	N	50/53	29	5	30	15	19,4	5	69,4
metaldehyde	9002-91-9	MO									
dazomet	533-74-4	NE, FU, HB, ST	N	50/53							
imazaquin	81335-37-7	PG									
chlorpropham	101-21-3	PG, HB			5	15	6	3	17	1	41
cyanamide	420-04-2	PG, HB									
dimethipin	55290-64-7	PG, HB									
brodifacoum	56073-10-0	RO	N	50/53							
bromadiolone	28772-56-7	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		
alachlor	15972-60-8		x		
atrazine	1912-24-9	x	x	carrots	1
azoxystrobin	131860-33-8	x		wheat	1
bentazon	25057-89-0		x		
bifenox	42576-02-3		x		
bromoxynil	1689-84-5		x		
captan	133-06-2	x		apple, pear, cherries canned, strawberries, table wine, cauliflower, Chinese cabbage, lettuce	8
carbendazim	10605-21-7	x		apple, strawberries, cauliflower, celery root, cucumber, lettuce, linnen seed, frozen peas, potatoes, savoy	10
carbetamide	16118-49-3		x		
carbofuran	1563-66-2	x	x	strawberries	1
chloridazon	1698-60-8		x		
chlorotoluron	15545-48-9		x		
chlorpropham	101-21-3	x		potatoes	1
chlorpyrifos	2921-88-2	x		apple, pear, cherries canned, table wine, cauliflower, carrots, celery root, zucchini	8
chlorpyrifos-methyl	5598-13-0	x	x	oats, strawberries, Chinese cabbage	3
cyanazine	21725-46-2		x		
cypermethrin	52315-07-8	x	x	cherries canned, broccoli, celery root, Chinese cabbage, lettuce, savoy, zucchini	7
deltamethrin	52918-63-5	x	x	wheat, apple, table wine, frozen spinach	4
desmetryn	1014-69-3		x		
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	x	wheat, rye, apple, pear, strawberries, table wine, cauliflower, carrots, celery root, Chinese cabbage, cucumber, onion, potatoes	13
dichlorprop-p	15165-67-0		x		
diflubenzuron	35367-38-5		x		
dimefuron	34205-21-5		x		

Pesticide	CAS Number	Ground Water	Surface Water	Food/ Crop	Nr.
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
dithiocarbamates (maneb, metiram, mancozeb, metam-sodium, propineb, thiram)				apple, pear, plum, strawberries, table wine, broccoli, cauliflower, carrots, celery root, Chinese cabbage, cucumber, kale, linnen seed, onion, frozen peas, savoy, zucchini,	17
endosulfan	115-29-7	x	x	apple, cherries canned, strawberries, broccoli, carrots, Chinese cabbage, linnen seed, onion, frozen peas, frozen spinach, zucchini	11
ethofumesate	26225-79-6		x		
fenitrothion	122-14-5				
fenpropimorph	67564-91-4	x		rye, celery root, savoy	3
flurochloridon	61213-25-0		x		
fluroxypyr	69377-81-7		x		
folpet	133-07-3	x		cherries canned, broccoli, cauliflower, Chinese cabbage	4
glyphosate	1071-83-6				
haloxyfop-methyl (r-isomer)	72619-32-0		x		
hexazinone	51235-04-2		x		
imazalil	35554-44-0	x		cherries canned, cauliflower, cucumber	3
ioxynil	1689-83-4		x		
iprodione	36734-19-7	x		wheat, cherries canned, strawberries, carrots, Chinese cabbage, cucumber, lettuce, linnen seed, frozen peas, potatoes, savoy, frozen spinach	12
isoproturon	34123-59-6		x		
lambda-cyhalothrin	91465-08-6	x	x	cherries canned, frozen spinach	2
lenacil	2164-08-1		x		
linuron	330-55-2		x		
MCPA	94-74-6		x		
MCPB	94-81-5		x		
mecoprop	7085-19-0				
metalaxyl	57837-19-1	x	x	wheat, broccoli, Chinese cabbage, lettuce, potatoes	5
metamitron	41394-05-2		x		
metazachlor	67129-08-2		x		
methamidophos	10265-92-6	x		Chinese cabbage, lettuce	2
methidathion	950-37-8		x		

Pesticide	CAS Number	Ground Water	Surface Water	Food/ Crop	Nr.
methyl bromide	74-83-9	x		wheat, rye, oats, broccoli, linnen seed	5
metobromuron	3060-89-7		x		
metolachlor	51218-45-2		x		
metribuzin	21087-64-9		x		
monolinuron	1746-81-2		x		
myclobutanil	88671-89-0	x		strawberries, cucumber	2
napropamide	15299-99-7				
oxadixyl	77732-09-3	x	x	apple, frozen spinach	2
penconazole	66246-88-6	x		cucumber	1
pendimethalin	40487-42-1		x		
permethrin	52645-53-1	x	x	broccoli, kale, mushroom cultivated (Agaricus), savoy, frozen spinach	7
phosalone	2310-17-0	x		apple, plum, cherries canned	3
pirimicarb	23103-98-2	x	x	apple, broccoli, Chinese cabbage, lettuce, linnen seed, frozen peas, zucchini	7
pirimiphos-methyl	29232-93-7	x	x	wheat, rye, oats, linnen seed	4
procymidone	32809-16-8	x		apple, cherries canned, strawberries, table wine, asparagus, broccoli, carrots, Chinese cabbage, cucumber, linnen seed, frozen peas, zucchini	12
prometryn	7287-19-6		x		
propyzamid	23950-58-5	x	x	strawberries, Chinese cabbage, potatoes, savoy, zucchini	5
quinmerac	90717-03-6				
simazine	122-34-9		x		
tebuconazole	107534-96-3				
terbuthylazine	5915-41-3		x		
terbutryn	886-50-0		x		
thiabendazol	148-79-8	x		wheat, pear, strawberries, asparagus, carrots, cucumber, kale, potatoes, savoy	9
thiometon	640-15-3				
tolclofos-methyl	57018-04-9	x		asparagus, carrots, lettuce	3
tolyfluanid	731-27-1	x		apple, strawberries, linnen seed, frozen peas	4
tri-allate	2303-17-5		x		
triadimefon	43121-43-3	x		celery root, savoy, frozen spinach	3
triadimenol	55219-65-3	x	x	rye, strawberries	2
triclopyr	55335-06-3		x		
trifluralin	1582-09-8	x		Chinese cabbage, linnen seed, frozen peas	3

Pesticide	CAS Number	Ground Water	Surface Water	Food/ Crop	Nr.
vinclozolin	50471-44-8	x	x	wheat, cherries canned, strawberries, table wine, broccoli, cauliflower, carrots, Chinese cabbage, kale, lettuce, linnen seed, mushroom cultivated (Agaricus), onion, frozen peas, savoy, frozen spinach, zucchini	19
zeta-cypermethrin	52315-07-8	x	x	cherries canned, broccoli, celery root, Chinese cabbage, lettuce, savoy, zucchini	7

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