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Monitoring of sulfonylurea herbicides in stream water draining intensively cultivated areas in southern Sweden during a 9-year period (1998-2006)

Winter wheat fields in catchment M 42, Skåne (Photo: J. Kreuger)

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Contents

Abstract

In 1998 a co-operation was initiated between DuPont and the Swedish University of Agricultural Sciences (SLU) with the aim of generating knowledge on environmental behaviour of sulfonylurea (SU) herbicides under Swedish agricultural conditions.

Results from a 9-year monitoring programme of SU herbicides in surface waters are presented. The report includes the analytical results from 536 samples collected during 1998 to 2006 from up to 4 intensively cultivated agricultural catchments in the southern portion of Sweden. The following seven SU herbicides were included: chlorsulfuron, flupyrsulfuron-methyl-sodium, metsulfuron-methyl, rimsulfuron, thifensulfuron-methyl, tribenuron-methyl and triflusulfuron-methyl. Results on detection frequency and concentration levels are presented and related to amounts applied in the investigated areas as well as to the Swedish Guideline Values (GV) for surface waters.

The application of SU herbicides to a variety of crops was quite comprehensive during the 9-year investigation period, with tribenuron-methyl being the most extensively used herbicide on 16-33% of the arable catchment area each year. Thifensulfuron-methyl was the secondly most widespread SU herbicide.

Analytical results showed that SU herbicides were occasionally detected in stream water draining intensively cultivated areas in Sweden (on average in 13% of the samples collected each year). These findings were essentially restricted to samples collected during or shortly after the main application season. The level of detected concentration was typically in the 0.01-0.1 µg/l range, with a few occasional findings of up to a maximum concentration of 0.21 µg/l. Concentrations exceeding the Swedish Guideline Values for the protection of surface waters occurred in a few samples each year (3% of the samples).

There was an overall good correlation between the frequency of detection of the different substances and the area treated, with tribenuron-methyl and thifensulfuron-methyl being the most frequently detected herbicides, in 13% and 6% of the samples, respectively. However, the concentrations of these substances exceeded the Guideline Values only on a few occasions during the entire 9-year investigation period. The two herbicides with the lowest Guideline Values, rimsulfuron and metsulfuron-methyl, were detected above GV slightly more regularly than the other herbicides.

Introduction

Plant protection products (pesticides) are used world wide within agriculture to protect crops and ensure the quantity and quality of the harvest. In order to minimise possible negative impact in the environment farmers are encouraged to reduce losses of pesticides due to wind drift or point sources such as spillage. However, pesticides might also be transported from the site of application via diffuse losses such as run-off and leaching. Much concern during the last decades have focused on the possible negative impact from pesticide use on both surface and ground water quality, especially if intended as drinking water. As a result monitoring programmes have been set up aiming to clarify the extent and magnitude of pesticide occurrence in waters.

Environmental monitoring of pesticides in Sweden started during the mid-1980s as short-term research based investigations of possible occurrence of pesticides in streams and rivers.

Long-term systematic monitoring of different compartments of the aquatic environment has gradually evolved with the most extensive monitoring programme carried out in a small agricultural catchment in southern Sweden, the Vemmenhög catchment (Kreuger, 1998). It was possible to demonstrate the importance of good application practices, e.g. safety distances to surface water inlets in the field, and the need to avoid misuse of pesticides on farmyards by using so called biobeds, with overall concentrations lowered by 90% since the onset of the monitoring programme (Kreuger & Nilsson, 2001).

In 1998 a co-operation was initiated between DuPont and the Swedish University of Agricultural Sciences (SLU) with the aim of generating knowledge on environmental behaviour of sulfonylurea (SU) herbicides under Swedish agricultural conditions. This group of herbicides had not previously been included in the monitoring program due to financial and analytical limitations. Hence, there was a general lack of information on possible occurrence and concentration levels of SU herbicides in waters. SU herbicides are applied at low rates (g/ha) and were therefore not considered as a possible major ground water contaminant. However, due to its potential to be toxic at low levels (µg/l) to aquatic weeds monitoring of surface waters was considered the most relevant matrix.

The joint DuPont/SLU long-term monitoring programme on SU herbicides started in 1998 in the Vemmenhög catchment in southern Sweden. In 2002 the programme expanded when the national monitoring programme, financed by the Swedish Environmental Protection Agency (Swedish EPA), was launched. This resulted in the Vemmenhög catchment and three new catchments being part of the national monitoring programme, which is operated by SLU. DuPont enlarged their monitoring commitment of SU herbicides to involve two of the new catchments, with the third area being included in the autumn of 2005. Hence there is today a long monitoring series of SU herbicides with samples collected from up to four different catchments and with parallel samples analysed at two different laboratories.

The aim of the monitoring programme was to quantify and follow variations of pesticides in time and space, both regarding concentrations and transported amounts. Pesticide findings in surface water were related to used amounts and agricultural practices in the catchments.

The overall objective of this report was to present results from a 9-year monitoring programme of SU herbicides, registered by the DuPont company, in stream water from agricultural areas. The report presents the analytical results from 536 samples collected during 1998 to 2006 from up to 4 intensively cultivated agricultural catchments in the southern portion of Sweden. The following seven SU herbicides were included: chlorsulfuron, flupyrsulfuron-methyl-sodium, metsulfuron-methyl, rimsulfuron, thifensulfuron-methyl, tribenuron-methyl and triflusulfuron-methyl. Results on detection frequency and concentration levels is presented and related to amounts applied in the investigated areas as well as to the Swedish Guideline Values (GV) for the protection of surface waters.

Background

Sulfonylurea (SU) herbicides were introduced as a new generation of plant protection products in Swedish agriculture during the mid-1980's. They were active at low application rates and acted by inhibiting the action of a key plant enzyme, not found in mammals or other animals, which stops plant growth and eventually causes plant death. Crops that can be treated with SU herbicides include barley, oats, rye, wheat, flax, corn, potatoes, triticale, grass ley and sugar beets.

Applied amounts of SU in Sweden have increased during the last two decades following the introduction of several new active ingredients (a.i.) and now amounts to ca 5 metric tons sold per year (KemI, 2007a) (Table 1). The cereal growing area treated with SU herbicides is comparable to other major herbicides such as the phenoxy acids (e.g. MCPA) and was estimated to cover slightly more than 50% of the area in Sweden (SCB, 2007). Application for most of the SU's takes place during spring and early summer after crops have emerged and at low rates (typically less than 20 grams of a.i. per hectare). These application rates are commonly one to two orders of magnitude lower than those used for other frequently used herbicides.

Table 1. Sold quantities (tons/year) of sulfonylurea herbicides in Sweden during 2002-2006 (KemI, 2007a), example of trade names and registration holder

Herbicide	2002	2003	2004	2005	2006	Trade name (e.g.)	Company
amidosulfuron	0.4	0.9	0.9	0.8	1.1	Gratil	Bayer
chlorsulfuron[1]	-	-	-	-	-	Glean	DuPont
flupyrsulfuron-methyl-Na	0.0	0.0	0.1	0.0	0.1	Lexus	DuPont
iodosulfuron-methyl-Na[2]	-	-	-	0.2	0.2	Hussar	Bayer
metsulfuron-methyl	0.1	0.1	0.1	0.1	0.1	Ally	DuPont
rimsulfuron	0.2	0.2	0.2	0.2	0.2	Titus	DuPont
sulfosulfuron	0.7	0.6	0.9	0.9	1.1	Monitor	Monsanto
thifensulfuron-methyl	0.6	0.7	0.7	0.7	0.4	Harmony	DuPont
tribenuron-methyl	2.4	2.4	2.1	1.9	1.4	Express	DuPont
triflusulfuron-methyl	0.5	0.4	0.4	0.5	0.4	Safari	DuPont
Total	*4.9*	*5.3*	*5.4*	*5.3*	*5.0*		

[1] Withdrawn from the Swedish market in December 1999.

[2] Registered on the Swedish market in February 2005. The main metabolite is metsulfuron-methyl.

SU herbicides are not expected to bioaccumulate due to low log P_{ow} at neutral and alkaline pH (Table 2). However, their relatively high water solubility, together with a low log P_{ow}, indicate that they might leach to deeper soil layer and potentially enter surface waters via drainage systems. Since their mode of action is very specific through the inhibition of the enzyme acetolactate synthase most aquatic species are quite tolerant to SU herbicides up to mg/l- or g/l-levels. However, certain specific water plants, in particular duckweed (*Lemna minor*), are, on the other hand, sensitive to SU herbicides at relatively low levels (µg/l). National aquatic guideline values (GV) for the SU herbicides range between 0.02 and 0.1 µg/l (KemI, 2007b & NV, 2008).

Table 2. Physico-chemical properties for SU herbicides included in the report (EFSA, 2008 & EU, 2008)

Herbicide	Log P_{ow}*^	Vapour pressure (mPa)#	Water solubility*# (mg/l)	Soil DT_{50} field (days)	pKa^
chlorsulfuron	-1.0	$3.1*10^{-6}$	12 500	36	3.4
flupyrsulfuron-methyl-Na	1.2	$<1*10^{-6}$	610	8	4.9
metsulfuron-methyl	-1.7	$1.1*10^{-7}$	2 790	10	3.8
rimsulfuron	-1.5	$8.9*10^{-4}$	7 300	11	4.0
thifensulfuron-methyl	-1.7	$7.5*10^{-6}$	2 240	10	4.0
tribenuron-methyl	0.8	$5.3*10^{-5}$	2 040	10	4.7
triflusulfuron-methyl	1.0	$6.0*10^{-7}$	260	6	4.4

* Values given for pH 7 where possible. # Values given at 20°C. ^Values given at 25°C.

Methods

Sampling sites

Water samples were collected from four monitoring catchments run by the Swedish national monitoring programme (Adielsson et al, 2007a; Adielsson et al, 2007b). The catchments are located in intensively cultivated regions of southern Sweden, i.e. Skåne (catchment M 42, the Vemmenhög catchment), Halland (N 34), Östergötland (E 21) and Västergötland (O 18) (Figure 1). These catchments were selected as being representative of soils, climate and agricultural practices typical for the region. The drainage area of the catchments ranges between 800 and 1600 ha (i.e. 8-16 km^2), with a major part of the land dominated (c. 90%) by agriculture (Table 3). Surface water samples were colleted at the outflow from the catchment, where also flow measurements were performed.

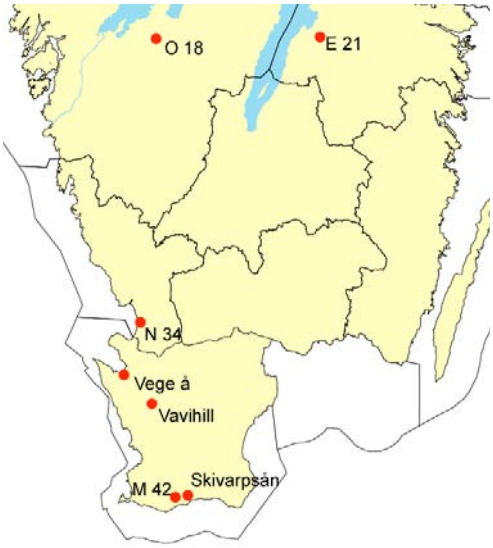

Figure 1. Location of sampling sites within the Swedish pesticide monitoring programme.

Sample collection

Water sampling for SU herbicides was started in spring 1998 in catchment M 42 (Skåne) and was enlarged in spring 2002 to include another three catchments, i.e. N 34 (Halland), E 21 (Östergötland) and O 18 (Västergötland). Sampling continued until late autumn 2006. Samples were collected by automatic, refrigerated (+4°C), ISCO-samplers as time-integrated weekly samples, with sub-samples each c. 80 minutes. Main sampling season was during May-October in the three northern areas (N 34, E 21 and O 18), with c. 20 samples per year. In the southern area (M 42), the sampling season normally stretches until December due to a longer cropping season in this region (c. 28 samples/year).

Collection of parallel samples for separate analysis by different laboratories was carried out during different time periods. In catchments M 42, N 34 and O 18 this was done during 2002-2006 and in catchment E 21 from autumn 2005 until the end of 2006. A total of 536 water samples were collected throughout the monitoring period of 1998-2006, of which 440 were collected as part of the joint DuPont/SLU monitoring programme and 405 within the national monitoring programme (run by SLU), with a total of 309 being parallel samples (Table 4).

Samples collected within the national monitoring programme were sent, ice-cooled, each week after the end of the sampling period directly to the laboratory and reached, in most cases, their destination within 24 hours. The DuPont samples were deep-frozen immediately after sampling at a nearby field station and transported, in a frozen condition, to the laboratory after the sampling season ended each year.

Data collection

Farmers operating within the monitoring catchments were interviewed each year to gather information on crops, fertilization and pesticide usage (i.e. type of pesticides, dosage and time

Table 3. Background information on monitoring catchments

Site	Area (ha)	Soil	Arable land	Temp.[a] (°C)	Precipit.[a] (mm/year)	Discharge[b] (mm/year)	pH	SS[c] mg/l	Tot-N[d] mg/l	Tot-P[e] mg/l
O 18	776	Clay loam	91%	6.2	571	348	7.9	59	5.9	0.24
E 21	1681	Loam	89%	6.0	477	160	7.9	12	10.7	0.07
N 34	1460	Loamy sand	92%	7.2	773	343	7.1	24	11.6	0.10
M 42	828	Sandy loam (till)	94%	7.7	662	213	7.7	17	8.4	0.12

[a] Temperature and precipitation are given as the 30-year annual average value from the nearest official meteorological station.
[b] Discharge is given as the annual average value measured at the catchment since sampling started (9-17 years ago).
[c] SS is given as the flow proportional annual average value for suspended solids in stream water.
[d] Tot-N is given as the flow proportional annual average value for total nitrogen in stream water.
[e] Tot-P is given as the flow proportional annual average value for total phosphorous in stream water.

Table 4. The number of water samples collected from each site and year analysed for sulfonylurea herbicides

	Site	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
DuPont	O 18	-	-	-	-	21	20	12	22	21
programme	E 21	-	-	-	-	-	-	-	6	18
	N 34	-	-	-	-	20	20	20	22	21
	M 42	23	24	26	30	21	16	29	19	29
National	O 18	-	-	-	-	21	22	19	22	20
programme	E 21	-	-	-	-	19	22	21	22	19
	N 34	-	-	-	-	19	22	20	21	21
	M 42	-	-	-	-	8	10	27	21	29
Parallel	O 18	-	-	-	-	21	20	12	22	20
samples	E 21	-	-	-	-	-	-	-	6	18
	N 34	-	-	-	-	18	20	20	21	21
	M 42	-	-	-	-	7	10	27	17	29

of spraying on a field level). All data collected are stored in a database (Access) at the Division of Water Quality Management, Dept. Soil Sciences, SLU.

Stream flow was continuously recorded at the outflow from each catchment by a water level gauge, thus allowing for calculations of transported amounts. Pesticides not detected were assigned a value of zero for the calculations and concentrations given as ‘trace’ was assigned the average between the limit of detection (LOD) and the limit of quantification (LOQ). Transported amounts as a percentage of applied amounts within the catchment were calculated to estimate the loss rate during 1998-2006.

Agricultural practices

Agricultural practices within the monitoring catchments were dominated by the growing of cereal crops on more than 50% of the farmland (Figure 2). In three of the areas (O 18, E 21 and M 42) winter cereals were more common, while in the catchment in Halland (N 34), with more coarse textured soils, spring cereals were preferred. Sugar beets were only grown in the two most southern catchments, N 34 and M 42, and potatoes were only grown in E 21 and in N 34. Oil seed rape was slightly more common in catchments O 18 and E 21 than in the other two and grass ley was only cultivated to some extent in area N 34. There were no major

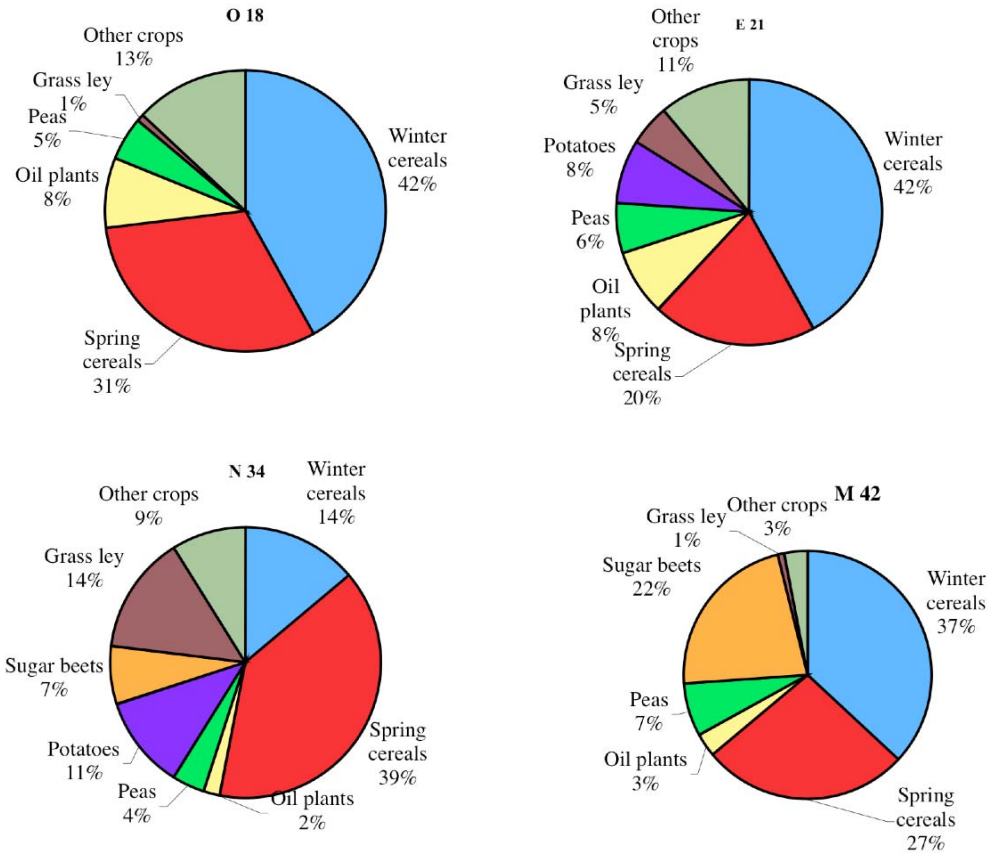

Figure 2. Average distribution of crops grown in the catchments during 2002-2006.

changes in cropping practices during the monitoring period in any of the catchments other than normal between-year fluctuations.

Used amounts of SU herbicides

Overall, the application of SU herbicides to a variety of crops has been quite comprehensive in the different catchments throughout the monitoring period. The most extensively applied herbicide was tribenuron-methyl used in cereals, with on average 16-33% of the arable area treated each year in the four catchments (Table 5 & 6). In the Skåne catchment (M 42) it was, on average, applied on one third of the arable area during the entire monitoring period. Thifensulfuron-methyl, also used in cereals, was the secondly most widespread SU herbicide covering on average 10-16% of the arable area each year in all four catchments.

Rimsulfuron, used against weeds in potatoes, was regularly applied in the two areas growing potatoes, i.e. in catchments E 21 and N 34, on 2-3% of the arable area. Metsulfuron-methyl was used in cereals by farmers in all the areas, except M 42, on 2-6% of the arable area. Triflusulfuron-methyl, used as a herbicide in sugar beets, was applied on a regular basis in catchments N 34 and M 42 on 2-9% of the arable area.

Chlorsulfuron was only used in minor amounts in area M 42 during the first year (1998), it was later withdrawn from the Swedish market in December 1999. Also, flupyrsulfuron-methyl has had a very limited use and was only applied in area M 42 during autumn 2004.

Table 5. Used amount and area treated with SU herbicides in areas O 18, E 21 and N 34 during 2002-2006

O 18	Used amount (kg)					Treated area (ha)					
Substance	**2002**	**2003**	**2004**	**2005**	**2006**	**2002**	**2003**	**2004**	**2005**	**2006**	**Average (% of total)**
chlorsulfuron	-	-	-	-	-	-	-	-	-	-	-
flupyrsulfuron-methyl	-	-	-	-	-	-	-	-	-	-	-
metsulfuron-methyl	0.1	0.1	-	0.1	-	28	17	-	17	-	12 (2 %)
rimsulfuron	-	-	-	-	-	-	-	-	-	-	-
thifensulfuron-methyl	0.4	0.3	1.0	0.3	0.4	91	58	238	91	103	116 (16 %)
tribenuron-methyl	0.8	1.1	0.9	0.6	0.5	225	281	305	173	198	236 (33 %)
triflusulfuron-methyl	-	-	-	-	-	-	-	-	-	-	-

E 21	Used amount (kg)					Treated area (ha)					
Substance	**2002**	**2003**	**2004**	**2005**	**2006**	**2002**	**2003**	**2004**	**2005**	**2006**	**Average (% of total)**
chlorsulfuron	-	-	-	-	-	-	-	-	-	-	-
flupyrsulfuron-methyl	-	-	-	-	-	-	-	-	-	-	-
metsulfuron-methyl	0.2	0.2	0.2	0.3	0.1	47	62	61	87	51	62 (4 %)
rimsulfuron	0.4	0.4	0.3	0.3	0.3	38	47	36	36	22	36 (2 %)
thifensulfuron-methyl	0.3	0.6	0.6	0.5	0.8	81	221	184	160	259	181 (12 %)
tribenuron-methyl	1.6	1.4	2.2	2.0	1.4	413	487	567	493	503	493 (33 %)
triflusulfuron-methyl	-	-	-	-	-	-	-	-	-	-	-

N 34	Used amount (kg)					Treated area (ha)					
Substance	**2002**	**2003**	**2004**	**2005**	**2006**	**2002**	**2003**	**2004**	**2005**	**2006**	**Average (% of total)**
chlorsulfuron	-	-	-	-	-	-	-	-	-	-	-
flupyrsulfuron-methyl	-	-	-	-	-	-	-	-	-	-	-
metsulfuron-methyl	0.1	0.3	0.2	0.3	0.3	46	92	73	98	87	79 (6 %)
rimsulfuron	0.6	0.6	0.5	0.4	0.4	51	58	41	35	35	44 (3 %)
thifensulfuron-methyl	0.3	0.4	0.7	0.8	0.7	61	95	173	201	158	138 (10 %)
tribenuron-methyl	0.9	0.9	0.9	0.8	0.4	196	193	264	261	162	215 (16 %)
triflusulfuron-methyl	0.4	0.1	0.3	0.1	0.5	40	10	24	7	36	23 (2 %)

Table 6. Used amount and area treated with SU herbicides in area M 42 during 1998-2006

M 42	Used amount (kg)								
Substance	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
chlorsulfuron	< 0.1	-	-	-	-	-	-	-	-
flupyrsulfuron-methyl	-	-	-	-	-	-	0.1	-	< 0.1
metsulfuron-methyl	-	-	-	-	-	-	-	-	-
rimsulfuron	-	-	-	-	-	-	-	-	-
thifensulfuron-methyl	0.5	0.7	0.3	0.2	0.5	0.3	0.2	0.5	0.3
tribenuron-methyl	1.4	1.3	0.6	0.8	1.7	0.9	0.5	0.4	0.2
triflusulfuron-methyl	-	0.2	0.4	0.7	2.5	1.2	0.5	1.7	2.3

M 42	Treated area (ha)									
Substance	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Average**
chlorsulfuron	4	-	-	-	-	-	-	-	-	0
flupyrsulfuron-methyl	-	-	-	-	-	-	19	-	5	2
metsulfuron-methyl	-	-	-	-	-	-	-	-	-	-
rimsulfuron	-	-	-	-	-	-	-	-	-	-
thifensulfuron-methyl	143	156	78	39	83	73	47	211	51	98 (13 %)
tribenuron-methyl	420	375	182	155	313	204	118	226	73	230 (30 %)
triflusulfuron-methyl	-	13	39	73	137	95	40	104	121	69 (9 %)

Analytical procedures

There were at total of seven sulfonylurea herbicides included in the analytical procedures during the monitoring period (Table 7). Analysis within the DuPont monitoring programme was performed at four different laboratories. During 1998 analysis was performed at Covance laboratories in the UK, during 1999-2000 at the DuPont Stine laboratories, USA and during 2001-2006 at AnalyCen Lidköping, in Sweden. Analysis within the national monitoring programme (run by SLU) during 2002-2006 was performed at the Section of Organic Environmental Chemistry, Department of Environmental Assessment. SLU.

Table 7. Overview of substances included in the analytical procedures by the different laboratories

Substances	1998	1999	2000	2001	2002	2003	2004	2005	2006
chlorsulfuron	-	-	-	-	S	A, S	A, S	A	A
flupyrsulfuron-methyl-Na	C	D	D	A	A	A, S	A, S	A, S	A, S
metsulfuron-methyl	C	D	D	A	A, S	A, S	A, S	A, S	A, S
rimsulfuron	C	D	D	A	A, S	A, S	A, S	A, S	A, S
thifensulfuron-methyl	C	D	D	A	A, S	A, S	A, S	A, S	A, S
tribenuron-methyl	C	D	D	A	A, S	A, S	A, S	A, S	A, S
triflusulfuron-methyl	C	D	D	A	A, S	A, S	A, S	A, S	A, S

C = Covance laboratories, UK.
D = DuPont Stine laboratories, USA.
A = AnalyCen, Lidköping, Sweden.
S = SLU (Section of Organic Environmental Chemistry), Uppsala, Sweden.

There is little information on the analytical procedures used by Covance laboratories, apart from the limit of quantification (LOQ) being 0.01 µg/l. The DuPont Stine laboratories used LC-MS/MS (thus confirming all values by detecting two MS/MS ion transitions) and with the LOQ being 0.05 µg/l. Analysis done by AnalyCen was performed using solid-phase extraction followed by LC-MS/MS with a LOQ of 0.01 µg/l, except during 2001 when a LOQ of 0.05 µg/l was applied.

Samples analysed at SLU, were acidified upon arrival, then extracted using solid-phase technique. Confirmation was preformed using LC-MS. All detects were confirmed using two masses and with a general limit of detection (LOD) in the range of 0.005-0.02 µg/l. The LOQ was generally 2-5 times higher than the LOD. Positive detects between LOD and LOQ were reported as trace concentrations (given in italic in Appendices 1-5).

Results & Discussion

Analytical results

A complete overview of the analytical results is presented in Appendices 1-5. There was an overall good agreement between the results from the parallel samples analysed, except on one occasion in early July 2006 in a sample from area E 21. When summarizing the results in tables and figures below, results from parallel samples were treated in the following way: *i*) If a substance was detected in both samples a mean concentration was calculated and included in the summary statistics; *ii*) If a substance was only detected by one of the laboratories that value was included in the summary statistics.

Table 8. Number of samples with SU herbicides present in percent of the total number of samples collected each year

Area	1998	1999	2000	2001	2002	2003	2004	2005	2006	Average 2002-2006
O 18	-	-	-	-	10%	9%	5%	18%	0%	8%
E 21	-	-	-	-	32%	18%	33%	27%	32%	28%
N 34	-	-	-	-	5%	5%	5%	18%	14%	9%
M 42	26%	4%	12%	7%	5%	6%	7%	9%	3%	6%
Overall	26%	4%	12%	7%	12%	10%	12%	18%	11%	13%

Overall, SU herbicides were detected on 95 occasions in a total of 67 samples out of 536 collected during 1998-2006, i.e. in 13% of the samples analysed (Table 8). These findings were essentially restricted to samples collected during or shortly after the main application season.

On average SU herbicides were detected in less than 10% of the samples collected each year, except in the catchment located in Östergötland (E 21) were SU herbicides were detected in 28% of the samples (Table 8). One possible explanation could be that this catchment is located in a region with normally quite dry conditions, resulting in low-flow conditions (Table 3), especially during the summer months, thus with little water to dilute the concentrations of pesticides transported to the stream.

The most frequently detected herbicide during the entire investigation period was tribenuron-methyl (Table 9), which was in good agreement with its widespread use in all four catchments (Table 5-6). There was an overall good correlation between the frequency of detection of the different substances and the area treated (Figure 3), thus indicating that the strongest influencing factor contributing to occurrence of these SU herbicides in streams was the amount used.

Table 9. Number of findings of the SU herbicides during 1998-2006 summarized for all four catchments in a total of 536 surface water samples

Substance	1998	1999	2000	2001	2002	2003	2004	2005	2006
chlorsulfuron	-	-	-	-					
flupyrsulfuron-methyl-Na								1	
metsulfuron-methyl					2	2	3	1	3
rimsulfuron					1	1	1	2	4
thifensulfuron-methyl					5	7	4	4	2
tribenuron-methyl	6	1		2	8	2	7	9	4
triflusulfuron-methyl			3		1		2	4	3
Number of samples collected	*23*	*24*	*26*	*30*	*83*	*82*	*89*	*89*	*90*

- = Not analysed.

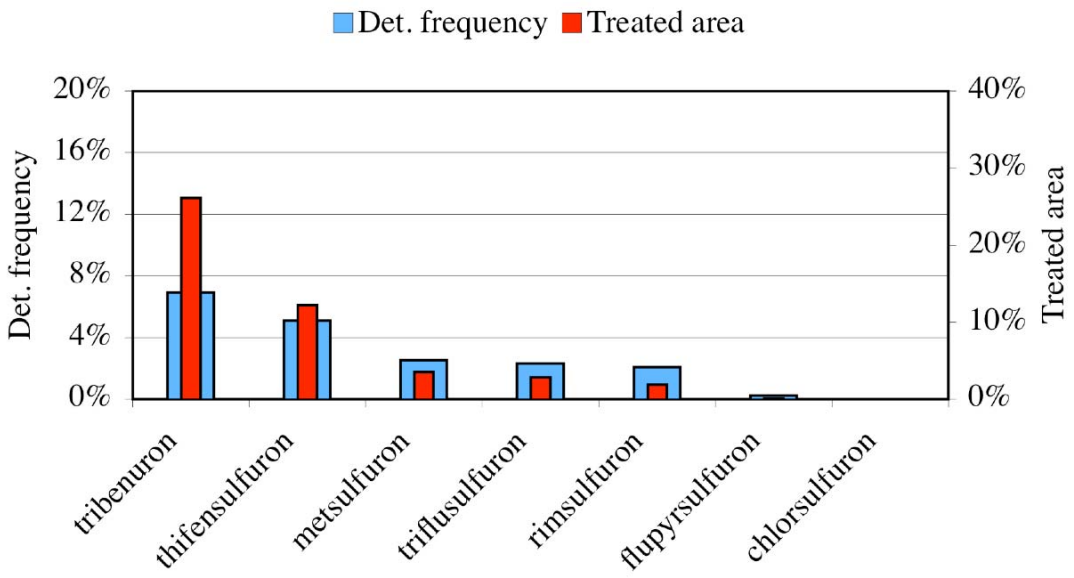

Figure 3. Overall detection frequency of SU herbicides in surface water from the four catchments during the monitoring period 2002-2006 in relation to the area treated (in percent of the total available area) during the same period.

The level of concentration (as time-weekly average concentration) was generally in the 0.01-0.1 µg/l range, with a few occasional findings of slightly higher concentrations (Figure 4). Maximum concentration detected during the 9-year period was 0.21 µg/l of rimsulfuron during 2004 (Table 10).

In the M 42 catchment (Skåne) there was work carried out during the mid-90's to mitigate point-source pollution of pesticides, leading to a 90% reduction in pesticide concentration levels in the stream (Kreuger & Nilsson, 2001). In this catchment the amount used of SU herbicides have been quite constant throughout the 9-year period 1998-2006 (1.3-4.7 kg/year) (Figure 5) and with an area treated with SU herbicides (as percent of arable land) comparable to the other catchments (Tables 5-6). Still, in this area there were fewer detections (Table 8) and at lower concentrations (Figure 6) than in the other areas. This could possibly be attributed to risk mitigation work done in this catchment right before the start of this investigation, work that has not been done in the same explicit way in the other catchments.

Table 10. Maximum concentration (µg/l) of SU herbicides during 1998-2006 summarized for all four catchments in a total of 536 surface water samples

Substance	1998	1999	2000	2001	2002	2003	2004	2005	2006
chlorsulfuron	-	-	-	-	<	<	<	<	<
flupyrsulfuron-methyl-Na	<	<	<	<	<	<	<	0.04	<
metsulfuron-methyl	<	<	<	<	0.04	*0.03*	0.10	0.05	0.04
rimsulfuron	<	<	<	<	0.05	0.01	0.21	0.09	0.08
thifensulfuron-methyl	<	<	<	<	0.18	0.05	0.05	0.08	0.03
tribenuron-methyl	*0.005*	*0.005*	<	*0.01*	0.12	0.04	0.04	0.06	0.07
triflusulfuron-methyl	<	<	*0.02*	<	0.05	<	*0.02*	0.02	0.04

- = Not included in the analytical procedure.
< = Not detected above the limit of detection.
Concentrations in italic were reported as trace values.

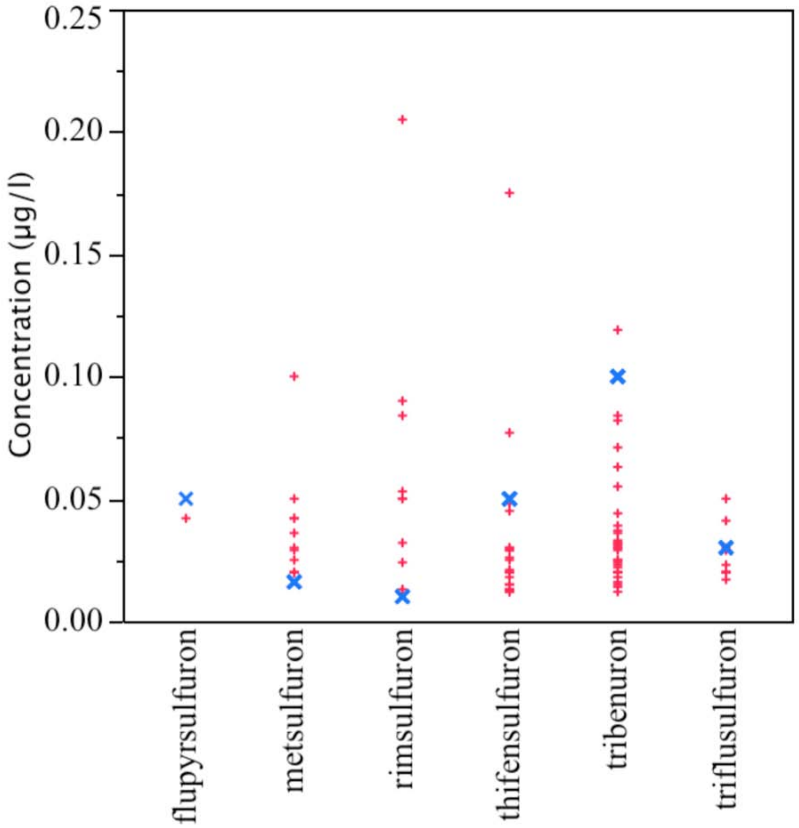

Figure 4. Concentration levels of individual SU herbicides (red crosses) detected during 2002-2006 in the four catchments in relation to each compound's Guideline value (blue cross).

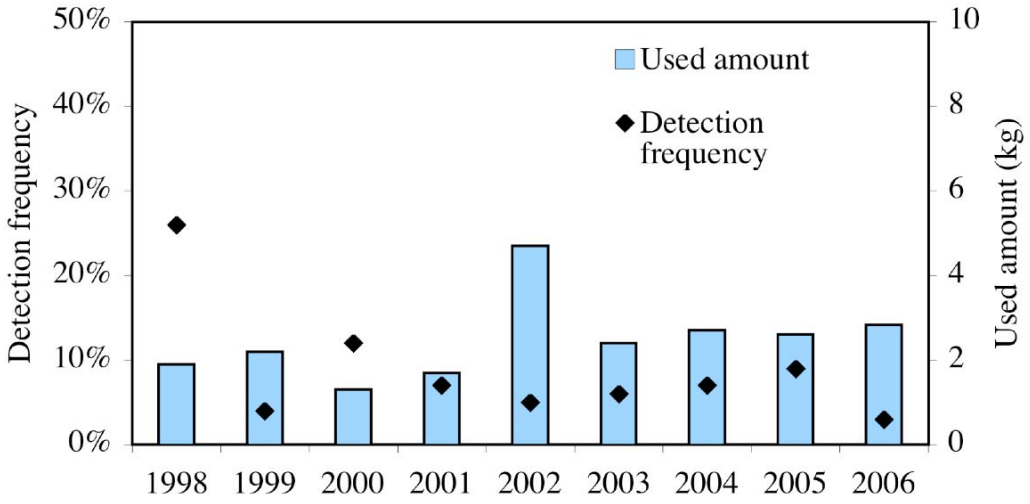

Figure 5. Used amounts of SU herbicides in the M 42 catchment (Skåne) in relation to detection frequency of SU herbicides in stream water during 1998-2006.

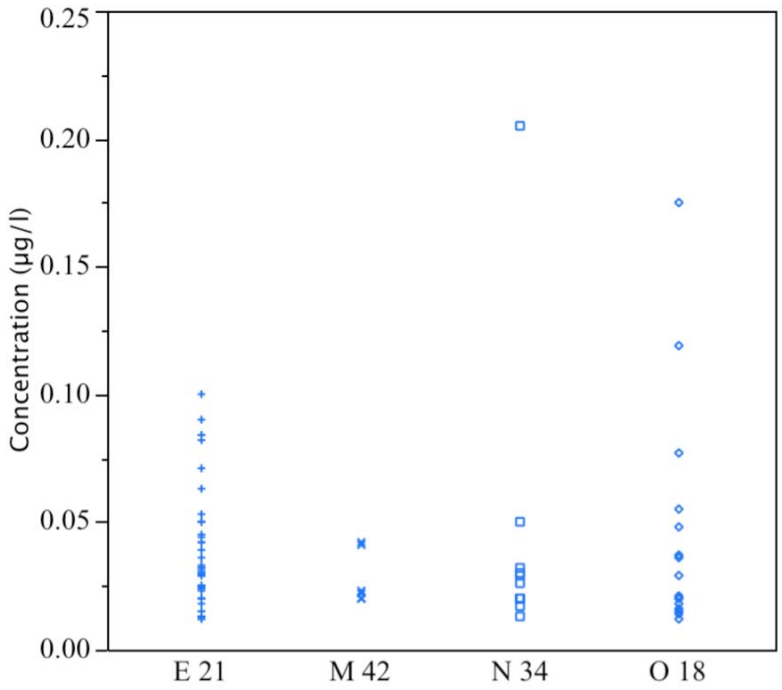

Figure 6. Concentration levels of SU herbicides detected in the four catchments during 2002-2006.

Transported amounts

Transported amounts were calculated and related to the amounts used in the area to estimate lost amounts. The loss rate (i.e. transported amount as a percentage of applied amount) as a whole varied between zero and 2 % during single years (Table 11). There was no single herbicide that seemed to have generally higher losses than any of the others (Table 12 & Figure 7). Losses were generally less than 0.3% of the applied amount during individual years, which is in accordance with other studies (Kreuger, 1998). As a whole the average losses was ~ 0.1% of the applied amount (Table 12).

During the monitoring program there were occasional extreme losses of single pesticides that most likely could be attributed to point-source contributions. For example there was a finding of rimsulfuron at 0.2 µg/l in one sample from area N 34 in June 2004 leading to a calculated loss of more ca 1.8 % of applied amount (Table 12). This was considerably above what was lost during other years and in other areas within the monitoring programme. In the M 42 catchment (Skåne), that was part of the risk mitigation information project during the 90's, losses were considerably lower than from the other three catchments (Figure 8).

Table 11. Total seasonal loss (transported amounts as a percentage of applied amounts) of SU herbicides during 1998-2006 in the different catchments

Substance	1998	1999	2000	2001	2002	2003	2004	2005	2006
Area O 18									
metsulfuron	-	-	-	-	0%	0%	-	0%	-
thifensulfuron	-	-	-	-	0.50%	0.40%	0.01%	1.16%	0%
tribenuron	-	-	-	-	0.16%	0.07%	0.01%	1.13%	0%
Area E 21									
metsulfuron	-	-	-	-	0.75%	0.17%	0.24%	0.30%	0.09%
rimsulfuron	-	-	-	-	0.23%	0%	0%	0.01%	0.04%
thifensulfuron	-	-	-	-	0.30%	0.11%	0.06%	0%	0.02%
tribenuron	-	-	-	-	0.53%	0%	0.03%	0.05%	0.03%
Area N 34									
metsulfuron	-	-	-	-	0%	0%	0%	0%	0%
rimsulfuron	-	-	-	-	0%	0.08%	1.79%	0%	0.60%
thifensulfuron	-	-	-	-	0.52%	0%	0%	0.11%	0%
tribenuron	-	-	-	-	0.12%	0%	0%	0.12%	0%
triflusulfuron	-	-	-	-	0%	0%	0%	1.98%	0.30%
Area M 42									
thifensulfuron	0%	0%	0%	0%	0%	0.03%	0%	0%	0%
tribenuron	0.01%	0.01%	0%	0.01%	0.18%	0%	0%	0%	0%
triflusulfuron	-	0%	0.05%	0%	0%	0%	0.01%	0.00%	0.02%

- = not investigated/not applied.
0% = not detected, although applied in the area.

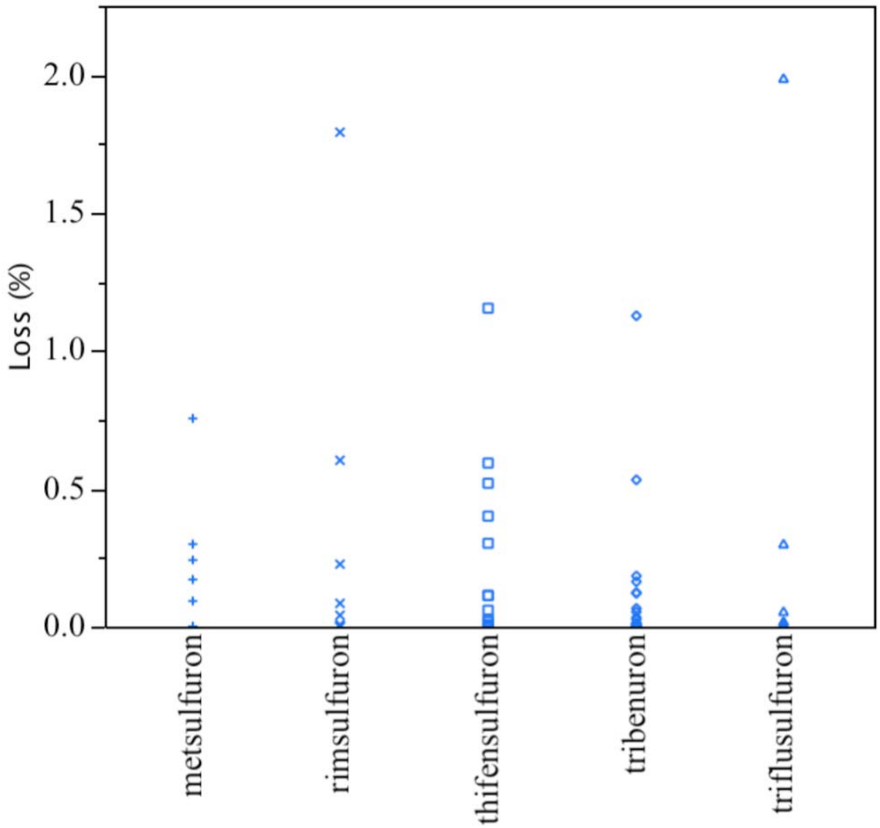

Figure 7. Total seasonal losses of individual SU herbicides during 1998-2006.

Table 12. Summary statistics of seasonal transport losses for individual SU herbicides during 1998-2006

Substance	N	Min	Median	Mean	75% quartile	Max
metsulfuron-methyl	13	0%	0%	0.12%	0.21%	0.75%
rimsulfuron	10	0%	0.02%	0.28%	0.32%	1.79%
thifensulfuron-methyl	24	0%	0%	0.14%	0.11%	1.15%
tribenuron-methyl	24	0%	0.01%	0.10%	0.11%	1.13%
triflusulfuron-methyl	13	0%	0%	0.18%	0.03%	1.98%

N = Number of calculations, i.e. number of times the substance was applied during the monitoring period in the four catchments.

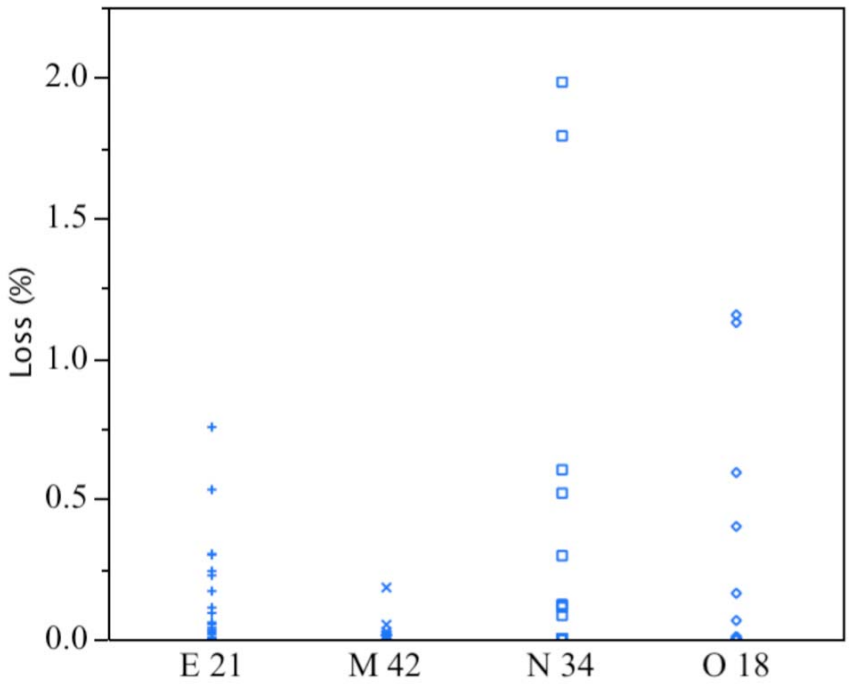

Figure 8. Total seasonal losses of SU herbicides in the four catchments during 1998-2006.

Guideline values

The Swedish Chemicals Agency (KemI) presented in 2004 national Guideline Values (GV) for the protection of surface waters including some 100 commonly used plant protection products and degradation compounds in Swedish agriculture (KemI, 2007b). The GV is the maximum concentration of each compound that is calculated not to give negative effects on aquatic organisms (Adielsson & Kreuger, 2006). These Guideline Values include six of the seven SU herbicides included in this monitoring programme (Table 13). During a recent re-evaluation process by KemI values for three of the SU herbicides (metsulfuron-methyl, thifensulfuron-methyl and tribenuron-methyl) were updated (NV, 2008). Detections were occasionally reported at levels close to the limit of detection, i.e. as a trace concentration. In that case the LOD reported had to exceed the GV in order to include that value as an exceedence.

Table 13. Swedish Guideline Values (GV) for sulfonylurea herbicides in surface water

Substance	GV (µg/l)
chlorsulfuron	-
flupyrsulfuron-methyl	0.05
metsulfuron-methyl	0.02
rimsulfuron	0.01
thifensulfuron-methyl	0.05
tribenuron-methyl	0.1
triflusulfuron-methyl	0.03

Overall, Guideline Values were exceeded on a total of 21 occasions in a total of 18 weekly samples out of 536 collected, i.e. in 3% of the overall number of samples collected during a 9-year period (Table 14). More than half of these exceedences occurred in the area E 21 (Östergötland), on 13 occasions. In the Skåne area (M 42) a GV was exceed on only one occasion.

The two herbicides metsulfuron-methyl and rimsulfuron with the lowest Guideline Values, 0.01-0.02 µg/l, were detected above GV slightly more regularly than the other herbicides (Figure 9). Tribenuron-methyl was the herbicide most frequently detected throughout the investigation period, but only on one occasion (in 2002) did the weekly average concentration exceed the Guideline Value of 0.1 µg/l (Table 14 & Figure 4).

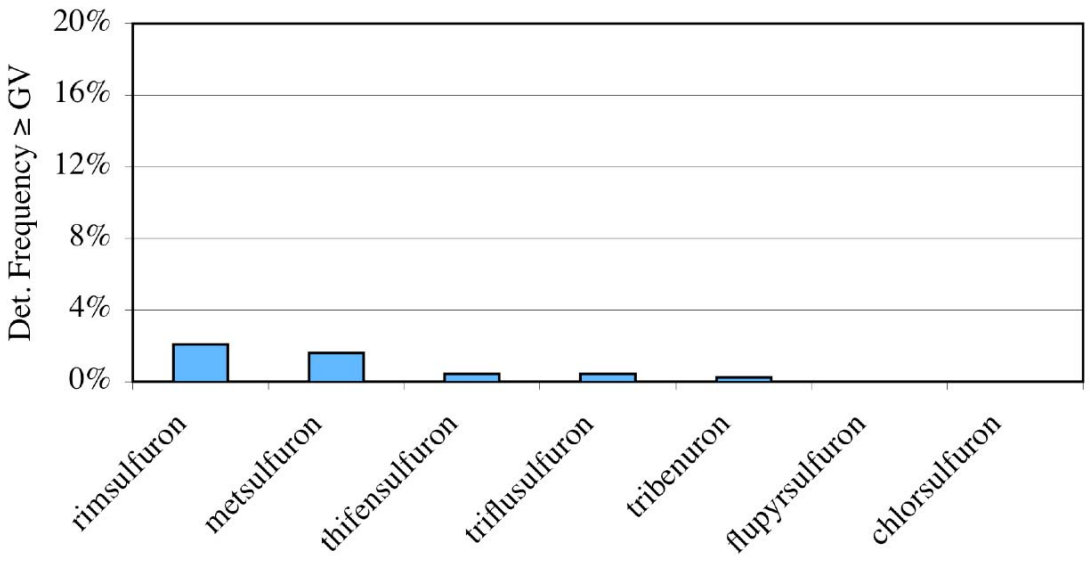

Figure 9. Overall detection frequency for SU herbicides exceeding their respective Guideline Value in surface water from the four catchments during the monitoring period 2002-2006.

Table 14. Number of occasion when SU herbicides exceeded GV during 1998-2006 summarized for all four catchments in a total of 536 surface water samples

Substance	1998	1999	2000	2001	2002	2003	2004	2005	2006
chlorsulfuron	-	-	-	-					
flupyrsulfuron-methyl-Na									
metsulfuron-methyl					1	1	2	1	2
rimsulfuron					1	1	1	2	4
thifensulfuron-methyl					1			1	
tribenuron-methyl					1				
triflusulfuron-methyl					1				1
Number of samples collected	*23*	*24*	*26*	*30*	*83*	*82*	*89*	*89*	*90*

- = Not analysed.

Acknowledgment

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Appendices

Appendix 1. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Västergötland (O 18) during 2002-2006.

Appendix 2. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Östergötland (E 21) during 2002-2006.

Appendix 3. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Halland (N 34) during 2002-2006.

Appendix 4. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Skåne (M 42) during 1998-2001.

Appendix 5. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Skåne (M 42) during 2002-2006.

Note:
Values given in italic in the appendices are trace concentrations, i.e. positive detects between the limit of detection (LOD) and the limit of quantification (LOQ).

Appendix 1. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Västergötland (O 18) during 2002-2006

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-05-06	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-13	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-20	SLU	<0.02	n.a.	<0.02	<0.08	<0.02	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-27	SLU	<0.02	n.a.	<0.01	<0.03	**0.21**	**0.16**	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	**0.14**	**0.077**	<0.01
2002-06-03	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-10	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-17	SLU	<0.01	n.a.	<0.01	<0.03	<0.02	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-24	SLU	<0.02	n.a.	<0.02	<0.03	<0.02	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-01	SLU	<0.01	n.a.	<0.01	<0.02	***0.015***	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-08	SLU	<0.01	n.a.	<0.01	<0.04	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-15	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-22	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-29	SLU	<0.01	n.a.	<0.01	<0.03	<0.02	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-08-05	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-09	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-16	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-23	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-30	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-07	SLU	<0.02	n.a.	<0.01	<0.03	<0.02	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-10-14	SLU	<0.02	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-21	SLU	<0.02	n.a.	<0.01	<0.04	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2003-05-12	SLU	<0.02	<0.02	<0.01	<0.02	<0.01	<0.03	<0.05
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-05-19	SLU	<0.01	<0.03	<0.01	<0.02	<0.01	<0.02	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-05-26	SLU	<0.01	<0.005	<0.005	<0.05	**0.021**	***0.013***	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	**0.015**	<0.010
2003-06-02	SLU	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-10	SLU	<0.01	<0.02	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-16	SLU	<0.02	<0.02	<0.01	<0.2	**0.049**	**0.033**	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	**0.048**	**0.040**	<0.010
2003-06-23	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-30	SLU	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-07	SLU	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-14	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.03
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-21	SLU	<0.01	<0.01	<0.005	<0.01	<0.01	<0.02	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-28	SLU	<0.02	<0.01	<0.01	<0.01	<0.005	<0.02	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-08	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-15	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005	<0.005
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-22	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-29	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-06	SLU	<0.02	<0.01	<0.005	<0.02	<0.008	<0.005	<0.005

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-13	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-20	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-27	SLU	<0.01	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-11-03	SLU	<0.01	<0.01	<0.01	<0.02	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-11-10	SLU	<0.01	<0.01	<0.01	<0.04	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-05-10	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-17	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-24	SLU	<0.01	<0.01	<0.007	<0.06	<0.007	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-01	SLU	<0.01	<0.01	<0.005	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-07	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-14	SLU	<0.005	<0.02	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-21	SLU	<0.01	<0.01	<0.01	<0.03	***0.02***	***0.02***	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-28	SLU	<0.005	<0.01	<0.005	<0.03	<0.01	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-12	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-19	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-26	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-06	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-13	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2004-09-20	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-09-27	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-04	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-11	SLU	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-18	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-25	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-05-09	SLU	n.a.	<0.005	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-16	SLU	n.a.	<0.005	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-23	SLU	n.a.	<0.005	<0.01	<0.005	**0.086**	**0.056**	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	**0.067**	**0.055**	<0.01
2005-05-30	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	***0.02***	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	**0.012**	**0.016**	<0.01
2005-06-06	SLU	n.a.	<0.005	<0.005	<0.005	**0.032**	**0.035**	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	**0.025**	**0.037**	<0.01
2005-06-13	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	***0.02***	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	**0.011**	<0.01
2005-06-20	SLU	n.a.	<0.007	<0.007	<0.01	<0.007	<0.007	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-27	SLU	n.a.	<0.005	<0.005	<0.005	<0.007	<0.007	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-04	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-11	SLU	n.a.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-18	SLU	n.a.	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-25	SLU	n.a.	<0.005	<0.008	<0.008	<0.008	<0.008	<0.008
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-05	SLU	n.a.	<0.01	<0.01	<0.006	<0.01	<0.01	<0.005

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-12	SLU	n.a.	<0.01	<0.01	<0.006	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-19	SLU	n.a.	<0.02	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-26	SLU	n.a.	<0.02	<0.02	<0.02	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-03	SLU	n.a.	<0.02	<0.02	<0.02	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-10	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-17	SLU	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-24	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-31	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-11-07	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-15	SLU	n.a.	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-22	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-29	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-05	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-12	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-19	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-26	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-03	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-10	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2006-07-17	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-24	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-04	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-11	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-18	SLU	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-25	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-02	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-09	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-16	SLU	n.a.	<0.01	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-23	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-30	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-06	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Appendix 2. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Östergötland (E 21) during 2002-2006

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-05-06	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-05-13	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	**0.032**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-05-20	SLU	<0.03	n.a.	<0.01	<0.05	***0.03***	**0.082**	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-05-27	SLU	<0.02	n.a.	**0.042**	<0.03	***0.03***	**0.084**	**0.05**
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-06-03	SLU	<0.02	n.a.	***0.02***	<0.06	<0.02	**0.031**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-06-10	SLU	<0.02	n.a.	<0.01	**0.05**	<0.02	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-06-17	SLU	<0.01	n.a.	<0.01	<0.04	<0.01	***0.015***	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-06-24	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-07-08	SLU	<0.02	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-07-15	SLU	<0.01	n.a.	<0.01	<0.05	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-07-22	SLU	<0.01	n.a.	<0.02	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-07-29	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-08-05	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-09-23	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-09-30	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-10-07	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-10-14	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-10-21	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-10-28	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2003-05-12	SLU	<0.02	<0.02	<0.01	<0.02	<0.01	<0.02	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-05-19	SLU	<0.02	<0.03	<0.02	<0.04	<0.02	<0.02	<0.03
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-05-26	SLU	<0.02	<0.005	<0.005	<0.05	***0.013***	<0.02	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-06-02	SLU	<0.03	<0.005	<0.005	<0.01	***0.013***	<0.02	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-06-10	SLU	<0.02	<0.02	***0.03***	<0.04	***0.015***	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-06-16	SLU	<0.02	<0.02	***0.025***	<0.06	***0.025***	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-06-23	SLU	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-06-29	SLU	<0.02	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-07-07	SLU	<0.01	<0.02	<0.005	<0.05	<0.01	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-07-14	SLU	<0.01	<0.01	<0.02	<0.02	<0.01	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-07-21	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-07-28	SLU	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-09-08	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-09-15	SLU	<0.005	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-09-22	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-09-29	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-10-06	SLU	<0.01	<0.01	<0.005	<0.02	<0.005	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-10-13	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-10-20	SLU	<0.03	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-10-27	SLU	<0.01	<0.005	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-11-03	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-11-10	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-05-07	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-05-17	SLU	<0.01	<0.01	<0.01	<0.01	**0.045**	**0.033**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-05-24	SLU	<0.01	<0.01	<0.004	<0.04	***0.012***	**0.044**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-05-31	SLU	<0.01	<0.01	**0.1**	<0.02	***0.013***	**0.032**	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-06-07	SLU	<0.005	<0.01	**0.036**	<0.02	<0.005	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-06-15	SLU	<0.01	<0.01	***0.02***	<0.04	<0.01	**0.03**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-06-21	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	**0.039**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-06-28	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	**0.029**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-07-05	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-07-12	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-07-19	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.02	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-07-26	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.01	<0.02
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-08-02	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-09-06	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-09-13	SLU	<0.005	<0.005	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2004-09-20	SLU	<0.005	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-09-27	SLU	<0.005	<0.005	<0.01	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-04	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-11	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-17	SLU	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-10-25	SLU	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-05-09	SLU	n.a.	<0.01	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-05-16	SLU	n.a.	<0.01	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-05-23	SLU	n.a.	<0.005	<0.01	<0.005	<0.01	**0.063**	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-05-30	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	**0.024**	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-06-06	SLU	n.a.	<0.005	**0.05**	<0.005	<0.01	***0.023***	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-06-13	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-06-20	SLU	n.a.	<0.005	<0.007	<0.007	<0.005	<0.005	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-06-27	SLU	n.a.	<0.005	<0.007	<0.005	<0.005	<0.005	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-07-04	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-07-11	SLU	n.a.	<0.005	<0.005	**0.09**	<0.005	<0.005	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-07-18	SLU	n.a.	<0.005	<0.01	<0.02	<0.005	***0.025***	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-07-25	SLU	n.a.	<0.005	<0.008	***0.024***	<0.005	<0.008	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-09-05	SLU	n.a.	<0.006	<0.01	<0.006	<0.01	<0.006	<0.005

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-12	SLU	n.a.	<0.006	<0.01	<0.006	<0.01	<0.006	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-19	SLU	n.a.	<0.01	<0.01	<0.005	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-26	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-03	SLU	n.a.	<0.02	<0.01	<0.01	<0.005	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-10	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-17	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-10-24	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-10-31	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-11-07	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006-05-15	SLU	n.a.	<0.01	<0.005	<0.005	<0.01	<0.005	<0.006
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006-05-22	SLU	n.a.	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-29	SLU	n.a.	<0.01	<0.006	<0.005	<0.01	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-05	SLU	n.a.	<0.01	<0.01	<0.006	***0.018***	**0.039**	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	**0.02**	<0.01
2006-06-12	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	***0.025***	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-19	SLU	n.a.	<0.01	<0.02	<0.01	**0.034**	**0.032**	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	**0.024**	**0.11**	<0.01
2006-06-26	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-03	SLU	n.a.	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	**0.042**	**0.084**	<0.01	**0.012**	<0.01
2006-07-10	SLU	n.a.	<0.01	***0.025***	**0.07**	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	**0.033**	**0.036**	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2006-09-04	SLU	n.a.	<0.01	***0.02***	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-11	SLU	n.a.	<0.01	<0.01	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-18	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-25	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-02	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-09	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-16	SLU	n.a.	<0.005	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-23	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-30	SLU	n.a.	<0.01	<0.01	<0.005	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-06	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Appendix 3. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Halland (N 34) during 2002-2006

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-05-13	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-21	SLU	<0.02	n.a.	<0.02	<0.04	***0.03***	***0.03***	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	**0.021**	**0.010**	<0.01
2002-05-27	SLU	<0.02	n.a.	<0.04	<0.06	<0.04	<0.03	<0.02
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-03	SLU	<0.02	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-10	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-17	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-24	SLU	<0.02	n.a.	<0.02	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-01	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-08	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-15	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-22	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-29	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-02	SLU	<0.01	n.a.	<0.01	<0.05	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-09	SLU	<0.02	n.a.	<0.01	<0.02	<0.02	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-16	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-23	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-30	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-07	SLU	<0.02	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-14	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-10-21	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-28	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-05-12	SLU	<0.02	<0.02	<0.02	<0.05	<0.01	<0.02	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-05-19	SLU	<0.02	<0.03	<0.03	<0.05	<0.02	<0.02	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-05-26	SLU	<0.02	<0.005	<0.005	<0.05	<0.005	<0.005	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-02	SLU	<0.01	<0.005	<0.005	<0.06	<0.005	<0.005	<0.005
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-10	SLU	<0.02	<0.02	<0.01	<0.05	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	**0.013**	<0.010	<0.010	<0.010
2003-06-16	SLU	<0.02	<0.02	<0.01	<0.1	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-23	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-30	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-07	SLU	<0.01	<0.01	<0.005	<0.02	<0.005	<0.01	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-14	SLU	<0.02	<0.02	<0.02	<0.1	<0.01	<0.02	<0.03
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-21	SLU	<0.01	<0.01	<0.01	<0.04	<0.005	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-28	SLU	<0.01	<0.01	<0.01	<0.03	<0.01	<0.02	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-08	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-15	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-22	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-09-29	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.04
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-06	SLU	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-13	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-20	SLU	<0.03	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-10-27	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.008	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-11-03	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2003-11-10	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2004-05-10	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-17	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-24	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-01	SLU	<0.01	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-07	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-14	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-21	SLU	<0.005	<0.01	<0.005	**0.3**	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	**0.11**	<0.01	<0.01	<0.01
2004-06-28	SLU	<0.01	<0.005	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-05	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-12	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-19	SLU	<0.01	<0.01	<0.01	<0.01	<0.008	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-26	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-06	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2004-09-13	SLU	<0.01	<0.01	<0.01	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-20	SLU	<0.01	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-27	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-04	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-11	SLU	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-18	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-25	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-09	SLU	n.a.	<0.005	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-16	SLU	n.a.	<0.01	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-23	SLU	n.a.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-30	SLU	n.a.	<0.01	<0.01	<0.01	***0.02***	***0.02***	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-07	SLU	n.a.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-13	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	***0.02***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-20	SLU	n.a.	<0.005	<0.007	<0.005	<0.005	<0.005	***0.02***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.014**
2005-06-27	SLU	n.a.	<0.005	<0.005	<0.005	<0.005	<0.005	**0.024**
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.016**
2005-07-04	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-11	SLU	n.a.	<0.01	<0.01	<0.02	<0.01	<0.02	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-18	SLU	n.a.	<0.005	<0.005	<0.005	<0.008	<0.08	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2007-07-25	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-05	SLU	n.a.	<0.006	<0.01	<0.006	<0.01	<0.006	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-12	SLU	n.a.	<0.006	<0.01	<0.006	<0.01	<0.006	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-19	SLU	n.a.	<0.01	<0.01	<0.006	<0.006	<0.006	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-09-26	SLU	n.a.	<0.01	<0.01	<0.006	<0.01	<0.006	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-03	SLU	n.a.	<0.02	<0.02	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-10	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-17	SLU	n.a.	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-24	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-31	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-11-07	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-15	SLU	n.a.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-22	SLU	n.a.	<0.01	<0.006	<0.005	<0.006	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-29	SLU	n.a.	<0.01	<0.006	<0.01	<0.01	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-05	SLU	n.a.	<0.01	<0.006	<0.006	<0.006	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-12	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-19	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-26	SLU	n.a.	<0.01	<0.01	**0.025**	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	**0.038**	<0.01	<0.01	<0.01
2006-07-03	SLU	n.a.	<0.01	<0.01	**0.06**	<0.01	<0.01	***0.04***
	DuPont	<0.01	<0.01	<0.01	**0.039**	<0.01	<0.01	**0.017**

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2006-07-10	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	***0.03***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-17	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-24	SLU	n.a.	<0.01	<0.006	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-04	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-10	SLU	n.a.	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-18	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-25	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-02	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-09	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-16	SLU	n.a.	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-23	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-30	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-06	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Appendix 4. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Skåne (M 42) during 1998-2001

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
1998-05-03	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-05-10	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-05-17	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-05-24	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-05-31	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-06-07	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-06-14	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-06-21	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	***0.005***	<0.01
1998-06-28	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-07-05	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	***0.005***	<0.01
1998-07-12	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-07-19	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	***0.005***	<0.01
1998-07-26	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-08-02	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-08-09	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-08-16	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-08-23	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-08-30	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-09-06	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	***0.005***	<0.01
1998-09-11	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	***0.005***	<0.01
1998-09-18	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	***0.005***	<0.01
1998-09-27	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1998-10-04	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1999-05-09	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-05-16	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-05-24	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-05-30	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-06-06	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-06-13	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	***0.005***	<0.05
1999-06-18	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-06-27	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-07-04	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-07-11	DuPont	n.a.	***0.004****	<0.05	<0.05	<0.05	<0.05	<0.05
1999-07-18	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-07-25	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-08-01	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-08-16	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
1999-08-22	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-08-29	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-09-05	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-09-12	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-09-19	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-09-26	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-10-03	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-10-13	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-10-18	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1999-10-25	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-05-07	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-05-14	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-05-21	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-05-28	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	***0.02***
2000-06-04	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	***0.003***
2000-06-11	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	***0.002***
2000-06-17	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-06-25	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-07-02	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-07-09	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-07-15	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-07-23	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-07-30	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-08-07	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-08-13	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-08-20	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-08-27	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-09-03	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-09-10	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-09-17	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-09-24	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-10-01	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-10-08	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-11-08	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-11-12	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2000-11-20	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-05-11	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2001-05-20	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-05-27	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-06-03	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-06-10	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-06-17	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-06-24	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-07-01	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-07-08	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-07-17	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-07-23	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-07-30	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-08-05	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-08-12	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-08-19	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	***0.01***	<0.05
2001-08-26	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	***0.01***	<0.05
2001-09-02	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-09-09	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-09-16	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-09-23	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-09-30	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-10-07	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-10-14	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-10-21	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-10-28	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-11-04	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-11-11	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-11-18	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-11-25	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2001-12-02	DuPont	n.a.	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

n.a. = Not analysed.

* Most likely this trace concentration was a false positive, since this active ingredient was not registered in Sweden until 2002.

Appendix 5. Concentrations (µg/l) of sulfonylurea herbicides in stream water from the catchment in Skåne (M 42) during 2002-2006

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-04-26	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-05	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-12	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	**0.028**	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	**0.016**	<0.01
2002-05-19	SLU	<0.01	n.a.	<0.01	<0.03	<0.02	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-05-26	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-02	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-09	SLU	<0.01	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-13	SLU	<0.01	n.a.	<0.01	<0.04	<0.01	<0.01	<0.01
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2002-06-21	SLU	<0.01	n.a.	<0.01	<0.03	<0.01	<0.01	<0.02
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-06-30	SLU	<0.01	n.a.	<0.01	<0.02	<0.01	<0.02	<0.01
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-07	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-14	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-21	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-07-28	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-08-04	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-08-11	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-08-19	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-08-25	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-09-01	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2002-10-06	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-13	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2002-10-20	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2003-05-12	SLU	<0.02	<0.03	<0.01	<0.02	<0.01	<0.02	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-05-19	SLU	<0.03	<0.03	<0.01	<0.05	<0.01	<0.04	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-05-26	SLU	<0.02	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-02	SLU	<0.005	<0.005	<0.005	<0.03	<0.005	<0.005	<0.005
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-09	SLU	<0.02	<0.02	<0.01	<0.03	<0.01	<0.02	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-16	SLU	<0.02	<0.02	<0.01	<0.1	***0.02***	<0.02	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-23	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-06-27	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.002
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-05	SLU	<0.01	<0.02	<0.005	<0.01	<0.01	<0.01	<0.02
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-13	SLU	<0.02	<0.02	<0.005	<0.03	<0.01	<0.02	<0.03
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-20	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-07-28	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-08-04	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-11-24	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-12-01	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2003-12-08	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2004-05-10	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-17	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-22	SLU	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-05-31	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-07	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-14	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-21	SLU	<0.01	<0.005	<0.005	<0.01	<0.005	<0.01	***0.02***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-06-28	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	***0.02***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-05	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-11	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-19	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-07-26	SLU	<0.01	<0.01	<0.005	<0.01	<0.008	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-08-02	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-08-09	SLU	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-08-30	SLU	<0.0005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-06	SLU	<0.005	<0.02	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-13	SLU	<0.005	<0.01	<0.01	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-09-20	SLU	<0.005	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2004-09-27	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-04	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-11	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-18	SLU	<0.01	<0.01	<0.005	<0.01	<0.005	<0.005	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-10-26	SLU	<0.005	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-11-01	SLU	<0.005	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-11-08	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-11-15	SLU	<0.005	<0.01	<0.005	<0.02	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-11-22	SLU	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-11-29	SLU	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2004-12-07	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-09	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-16	SLU	n.a.	<0.005	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-23	SLU	n.a.	<0.005	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-05-30	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-06	SLU	n.a.	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-13	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-20	SLU	n.a.	<0.005	<0.005	<0.005	<0.005	<0.005	***0.023***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-06-27	SLU	n.a.	<0.005	<0.005	<0.007	<0.01	<0.005	<0.005

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-04	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-11	SLU	n.a.	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-18	SLU	n.a.	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-07-25	SLU	n.a.	<0.005	<0.005	<0.008	<0.02	<0.008	<0.008
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-10-31	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.01	**0.042**	<0.01	<0.01	<0.01	<0.01	<0.01
2005-11-07	SLU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-11-14	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-11-21	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-11-28	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-12-05	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-12-12	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2005-12-19	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005-12-27	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006-01-03	SLU	n.a.	<0.01	<0.01	<0.01	<0.02	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006-01-10	SLU	n.a.	<0.01	<0.005	<0.01	<0.01	<0.01	<0.005
	DuPont	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2006-05-08	SLU	n.a.	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-15	SLU	n.a.	<0.01	<0.005	<0.005	<0.005	<0.005	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-05-22	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
2006-05-29	SLU	n.a.	<0.01	<0.01	<0.005	<0.006	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-05	SLU	n.a.	<0.01	<0.01	<0.01	<0.006	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-12	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-20	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-06-26	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-03	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	***0.04***
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.043**
2006-07-10	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-17	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-24	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-07-31	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-08-21	SLU	n.a.	<0.005	<0.01	<0.005	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-08-28	SLU	n.a.	<0.005	<0.005	<0.005	<0.02	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-04	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-11	SLU	n.a.	<0.01	<0.005	<0.01	<0.005	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-18	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.006	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-09-25	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.006
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-02	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-09	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-16	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-23	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Date of collection	Sample ID	chlorsulfuron	flupyrsulfuron-methyl-Na	metsulfuron-methyl	rimsulfuron	thifensulfuron-methyl	tribenuron-methyl	triflusulfuron-methyl
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-10-30	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-06	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-13	SLU	n.a.	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-20	SLU	n.a.	<0.01	<0.02	<0.02	<0.01	<0.01	<0.005
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-11-27	SLU	n.a.	<0.01	<0.02	<0.01	<0.02	<0.02	<0.03
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2006-12-04	SLU	n.a.	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01
	DuPont	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Monitoring site in catchment M 42, Skåne (Photo: J. Kreuger)

Distribution

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