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REVIEW OF GLYPHOSATE AND AMPA IN DRINKING WATER IN SELECTED EUROPEAN COUNTRIES

FINAL REPORT

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SUMMARY

For this report, available information for glyphosate and AMPA in drinking water for Belgium, Denmark, France, Germany, Ireland, Spain, Sweden, The Netherlands and the UK have been reviewed.

Drinking water quality reports issued by the national responsible authorities in Belgium, Denmark, France, Germany, Ireland, Spain, the Netherlands and the UK, together with some additional information, were assessed with respect to glyphosate and AMPA in drinking water for public supplies (private supplies also for Demark and Northern Ireland), and in some cases for raw water intakes (Germany and the Netherlands). For Sweden we had access to a pesticides database which included drinking water results.

The results are summarised in **Table 1**. Whilst glyphosate and AMPA were reported to have been present in water intakes in France, Germany and The Netherlands, no glyphosate exceedances of the individual pesticide standard for drinking water of 0.1 µg l^{-1} were reported from Belgium, Germany and Ireland. A small number of sporadic results > 0.1 µg l^{-1} have been reported from France (25 samples in the period 2001-03), in The Netherlands (two each in 2005 and 2006) and the UK (four in England & Wales in 2004, three in Northern Ireland in 2004 and one in 2005). All were isolated detections and none were considered significant, i.e. no reports of improvement measures being needed because of the presence of glyphosate in drinking water. Three of the four exceedances in England & Wales were attributed to probable problems with the analysis, due to the occasional occurrences; similar explanations may well apply to exceedances reported from elsewhere. Whilst there were no reported exceedances for glyphosate (or AMPA) in large public supplies in Denmark, there were some detections and exceedances in small private supplies. Special investigations revealed that all wells affected were abstracting shallow groundwater (probably supplied untreated) in conditions where there was rapid infiltration of surface water from nearby fields or run-off from treated court yards in the vicinity. A similar situation may be the case in Sweden, where a small number of glyphosate and AMPA detections and exceedances were found in drinking water; these seemed to be mainly derived from groundwater, but no further sample details were available.

Glyphosate and AMPA were not included in the list of 112 pesticides and metabolites monitored in drinking water in Spain; no selection criteria for pesticides monitoring were presented, although it would normally be expected that monitoring should focus on those substances likely to be found, e.g. on the basis of usage and occurrence in raw water sources.

Evidence of the effective removal of glyphosate and AMPA at early treatment stages (artificial recharge or bank filtration, sand filtration) was also obtained from a major water supplier in Germany. Other information also shows the effective removal of these substances by water treatment processes.

AMPA is not considered a relevant metabolite in The Netherlands, and therefore not reported in drinking water; it appears to be similarly treated in the other countries, although reported in France.

Table 1 Summary of glyphosate (Gly) and AMPA monitoring and detection in drinking water in eight EU countries

Country	Year(s)	Monitoring		Detection (number)		Concentration ≥ 0.1 µg l^{-1} (number)	
		Gly	AMPA	Gly	AMPA	Gly	AMPA
Belgium	2002-04	☹	☹	?	?	0	0
Denmark	2002-04 [1]	😐	😐	?	?	0	0
	2001-05 [2]	☺	☺	54 [3]		21 [3]	
France	1993-98	☹	☹	?	?	0	0
	2001-03	☺	☺	26	22	18	15
	2004-06	😐	😐	?	?	0	0
Germany	2002-04	😐	😐	?	?	0	0
	2005	☺	☺	0	0	0	0
Ireland	2005-06	☹	☹	?	?	0	0
Sweden	2000-07	☺	☺	7	14	4	≥ 4
Spain	2002-04	🚫	🚫	-	-	-	-
The Netherlands	2000-06	☺	😐	14	?	2	?
UK							
- England	2000-06	☺	☹	?	?	4	?
- Northern Ireland	2002-06	☺	☹	?	?	6 [4]	?
- Scotland	2005	☹	☹	?	?	≤ 2 [5]	?

Notes: ☺ = monitored
😐 = probably monitored
☹ = not known
🚫 = not monitored
- = not relevant
? = no information
1) large public supplies
2) small/private wells of shallow groundwater, probably untreated
3) glyphosate and AMPA presented as combined amounts
4) 2 of these in private supplies
5) only 2 exceedances of the pesticide standard but substance(s) not specified

1. INTRODUCTION

Glyphosate is the active ingredient in non-selective herbicides widely used for the post-emergence control of annual and perennial weeds in a variety of agricultural and non-crop applications. The results of more than 25 years of laboratory and field studies have shown that glyphosate has a very low potential to reach groundwater due to the compound's strong soil binding properties and biodegradability in soil. On the other hand, surface water is totally exposed, and therefore more vulnerable to the entry of pesticides. Glyphosate, and its metabolite AMPA, have been reported in surface water monitoring studies conducted by several Member States (MS).

Although it has been shown that glyphosate and AMPA are removed effectively in water treatment, even by simple preliminary treatment, such as sand filtration (Hall and Camm, 2007, Schlett *et al*., 2005), the presence of glyphosate and AMPA in surface water used for drinking water production has generated some debate at MS level.

In an attempt to alleviate these concerns, Monsanto have asked WRc to provide a review of available drinking water monitoring data on glyphosate and AMPA.

Reporting by EU Member States to the Commission under the Drinking Water Directive 98/83/EC (1998) will be incorporated into WISE (Water Information System for Europe) in the near future. However, at present, there are no clear indications of the details of reporting, and data are available in various forms for some Member States.

For this report, available information for Belgium, Denmark, France, Germany, Ireland, Spain, Sweden, The Netherlands and the UK have been reviewed. Information was obtained from websearches and professional contacts.

Information was sought also for the Czech Republic, Greece and Italy. However, we have been unable to obtain any relevant information from Greece and Italy.

From the Czech Republic we received confirmation that, whilst over 40 000 analyses were carried out for 72 pesticides in drinking water supplies in 2007, and similarly in 2005 and 2006, glyphosate was not among the substances monitored. Selection of the pesticides for monitoring is the responsibility of the water suppliers, on the basis of their likely presence, but is also determined by the availability of suitable analytical techniques (Dr. František Kozišek, National Institute of Public Health, Prague, personal communication, 2008).

2. BELGIUM

Drinking water distributed in the Brussels Region and in Wallonia is produced mainly from groundwater (80%) and the rest from surface water, whilst drinking water produced in Flanders originates equally from groundwater and surface water; in addition, a quarter is provided from neighbouring countries or regions.

2.1 Flemish Region

The most recent available drinking water quality report for the Flemish Region (VMM, 2004) covers the period 2002 - 2004. The results for 2002 were not presented in the report, only a comment was made that the public health was in no instance threatened by the quality of drinking water in 2002. In 2003 and 2004 there were no failures of the pesticides parameters (individual or total pesticides) from about 2 500 pesticides analyses in drinking water samples taken from consumers' taps. The substances concerned were not listed.

2.2 Walloon Region

The latest report available on drinking water quality for the Walloon Region (DGRNE, 2004, reported in AQUAWAL, 2006), reported no failures of the pesticides parameters (individual and total) from almost 600 pesticide analyses in drinking water samples taken from consumers' taps in 2002 - 2003. The substances concerned were not listed.

3. DENMARK

The most recent and first publicly available report on the quality of drinking water in Denmark covers the period 2002-2004 (Miljøstyrelsen, 2007). It was published to satisfy the requirements of the EU Drinking Water Directive (1998) and therefore covers only abstractions greater than 350 000 m^3 per annum.

Danish water supply is derived almost entirely from groundwater (99%), only 1% from surface water. Wells with abstractions greater than 350 000 m^3 per annum provide some 270 million m^3 per annum, whilst smaller abstractions from about 33 000 wells provide 150 million m^3 per annum. In addition there are an estimated 70 000 – 80 000 single or small abstractions, defined as wells or boreholes providing water for less than 10 properties.

In the period 2002 - 2004 only 2 samples were analysed for pesticides and there was no exceedance of the pesticides parameter (individual – 0.1 µg l^{-1}, or total pesticides – 0.5 µg l^{-1}) (Miljøstyrelsen, 2007). However, there is no information on the substances analysed, although it is likely that glyphosate and AMPA would have been included, since these are part of the national groundwater monitoring programme (Brüsch, 2006).

A separate study focusing on glyphosate and AMPA in small supplies was carried out (Brüsch and Rosenberg, 2008). The study was designed to further investigate earlier findings in 2001/2002, when glyphosate and AMPA were found in 38 of 193 small private water supplies for households in the Storstrøm County, which had the highest number and proportion of findings, as shown in **Table 3.1** (this covers three other counties as well).

Table 3.1 Glyphosate and AMPA in small supply wells/boreholes in Denmark (source: Brüsch and Rosenberg, 2008)

County	Number of wells analysed	Wells with Glyphosate and AMPA detection		Wells with findings ≥ 0.1 µg l^{-1}	
		Number	%	Number	%
Købnhavn	28	3	10.7	0	0
Storstrøm	193	38	19.7	15	7.8
Sønderjylland	195	3	1.5	2	1
Viborg	199	10	5	4	2
Total – 4 counties	**615**	**54**	**8.8**	**21**	**3.4**

The investigations initially focused on 38 wells in the Storstrøm County, where glyphosate and AMPA had been detected in 2001/2002. Repeat analyses in 2005, using the Danish Standard MK2275 GC-MS method, revealed glyphosate and AMPA in 15 of the wells, in 10 of them at concentrations above 0.1 µg l^{-1}. The wells were situated on arable land dominated by till (clay) and all abstracted water from close to the surface. Neither glyphosate nor AMPA were found at any deep groundwater drillings.

Twelve of the above wells were investigated in more detail and it was concluded that the main sources of glyphosate and AMPA were from spraying court yards and/or from nearby treated fields. The sites were dominated by till deposited by the Young Baltic Ice sheet during the last Ice Age. The till is characterised by horizontal fracture zones generated by ice segmentation, on average to a depth of about 2.5 m, although this depth varies locally. In addition, several macro pore systems (root channels, worm burrows or fractures) were found near some wells, all contributing to rapid transfer of surface water to the shallow water wells.

A correlation was observed between increasing distance from the source and decreasing glyphosate/AMPA concentrations. It was also concluded that both glyphosate and AMPA concentrations decreased with increasing depth of water.

It was also considered that similar well vulnerability was unlikely in sandy areas, unless surface water could infiltrate directly towards the wells from sprayed court yards or other treated areas in the immediate vicinity of wells.

Overall it seems clear that contamination with glyphosate and AMPA was a phenomenon of rapid transfer of surface water to shallow groundwater wells, rather than contamination of groundwater at depth.

4. FRANCE

A special report on pesticides in drinking water (Ministère de la Santé et des Solidarités, 2001 - 2003) summarises data for pesticides in drinking water for the years 2001 - 2003. From a total of some 560 000 pesticide analyses, glyphosate and AMPA were detected on a few occasions, but these were not among the list of 50 of the most frequently detected substances. There is a comment, nevertheless, that this may be an underestimate of their occurrence, because the analytical techniques were often inadequate, e.g. difficult to quantify at concentrations around 0.1 µg l^{-1}. However, this observation could equally suggest that the detections of these substances were not entirely reliable.

The data for glyphosate and AMPA are summarised in **Table 4.1**. This shows that glyphosate and AMPA were detected in a small percentage of samples, some below and some above 0.1 µg l^{-1}. Since the health-based value (HV) of 900 µg l^{-1} for glyphosate (AMPA not indicated; Ministère de la Santé et des Solidarités, 2001 – 2003, Annex 1) and 20% of this value seems to have been used as a standard in the presentation of the results, little can be inferred of the actual concentrations of those values which exceeded the drinking water limit of 0.1 µg l^{-1}. There are no details of the detection limits (LoD) or limits of quantification (LoQ), other than that the LoD must have been ≤ 0.1 µg l^{-1} in order for the results not to have been rejected in the overall assessment.

Table 4.1 Glyphosate and AMPA in drinking water in France, 2001 - 2003 (source: Ministère de la Santé et des Solidarités, 2001 – 2003)

Number analysed	Results discarded *	Results < LoD	Results ≥ LoD ≤ 0.1 µg l^{-1}	Results ≥ 0.1 µg l^{-1} ≤ 20% HV	Results ≥ 20% HV ≤ HV	Results > HV
Glyphosate						
3 125	38	3 061	8 (0.26%)	18 (0.58%)	0	0
AMPA						
1 376	36	1 318	7 (0.51%)	15 (1.1%)	0	0

Notes: * because LoD > 0.1 µg l^{-1}
LoD = limit of detection or quantification
HV = Health-based value (FAO/WHO 1997 proposed value of 900 µg l^{-1} seems to have been used for glyphosate; no information for AMPA)

AMPA seems to be considered relevant, at least in terms of reporting exceedances. Although AMPA is not mentioned specifically in the guidance issued in 1998 (Ministère de la Santé et des Solidarités, 2001 – 2003, Annex 1), it implies that all metabolites exceeding the 0.1 µg l^{-1} drinking water limit should be reported; however, the necessity for actions, such as remedial measures, seems to depend mainly on the health-based limits (WHO or the Advisory Committee's own assessment) of the substances concerned, and therefore looks unlikely to be relevant in the case of AMPA.

Whilst the WHO suggested a health based guide value for glyphosate of 5 mg l^{-1} in 1998, based on an ADI (Acceptable Daily Intake) of 1.75 mg kg^{-1} bodyweight, the 2004 edition

indicated that a guide value of 0.9 mg l^{-1} would be appropriate, based on an ADI of 0.3 mg kg^{-1} bodyweight, but considered it unnecessary to set a value, since typically the concentrations found were far below this value. The French recommendations of 2008 (Afssa, 2008), which comprise a list of health based maximum values for pesticides and metabolites in drinking water, does not include glyphosate or AMPA. This is because values were set only for substances which exceeded the 0.1 µg l^{-1} drinking water limit at least once in the period 2004-2006.

More details of the earlier exceedances (2001 - 2003, see above) are presented in ISL (2007). Background information was gathered for the 25 waterworks, but only received for 18, together accounting for 19 of the 26 glyphosate detections. Of these, four used surface water as their raw water intakes, the remainder used groundwater.

The glyphosate concentrations, together with names of water works and other relevant information, where available, are shown in **Table 4.2**. The total of 26 detections of glyphosate in the period 2001 – 2003 originated from 25 water works, i.e. one single detection at each of 25 works and two at another in a period of 3 years, although monthly samples were analysed in many cases. It is worth noting that at Level 1, the only treatment plant with two detections, reported weekly sampling; yet 4.7 µg l^{-1} glyphosate were found on 7 July 2003, 1.3 µg l^{-1} on 16 September 2003, and nothing in between. One of the glyphosate detections (at Kerbellec) turned out to be for raw water rather than finished drinking water. Strangely, the majority of glyphosate detections were at sites where groundwater is used, although the presence of glyphosate in groundwater is rare (Horth *et al*., 2004). Not surprisingly, further investigations by ISL failed to establish any coherent relationships between these detections and factors, such as seasonal occurrence, raw water quality, type of aquifer, analysis, water treatment etc. In fact, several of the samples with glyphosate were found in chlorinated waters, although it has been shown that chlorine (and other treatment processes) effectively remove glyphosate (Hall and Camm, 2007; Schlett *et al*., 2005). Overall, the evidence points to isolated detections, most likely due to contamination at the sampling stage or problems with analyses, rather than any indication of a persistent presence in drinking water.

The special reports covering pesticides in drinking water in 2004, 2005 and 2006 (Direction Générale de la Santé, 2004; 2005; and 2006) only refer to compliance with the pesticides parameter in general; most exceedances were short-lived and did not require measures, and the pesticides concerned are not listed specifically. Only a small number of specific substances are listed because of their more persistent presence, requiring measures to be taken. These are as follows: triazines including metabolites, chlordecone, diuron, isoproturon, aminotriazole, 2,4-MCPA, diquat and paraquat. There is no reference to glyphosate; therefore, if there had been any detections in the period 2004 - 2006, these would have been short-lived and not giving rise to any need for action. Moreover, from the fact that no health based values were set by the authorities in 2008 (Afssa, 2008), it may be assumed that there were no exceedances of the drinking water limit for glyphosate or AMPA during 2004 - 2006, since the list included all pesticides and metabolites which had exceeded the drinking water limit of 0.1 µg l^{-1} at least once in the period 2004 - 2006 (see above).

Table 4.2 Details of glyphosate detections in drinking water in France, 2001 – 2003 (source: ISL, 2007)

Waterworks or location	Source water	Sampling frequency	Date detected	Concentration µg l^{-1}
2001				
Pont Ar Bled	Surface water	1 / month	16/01/2001	0.08
Petit Paris	Surface water	1 / month	24/01/2001	0.09
Le Yar	?	?	04/12/2001	0.1
2002				
Le Déversoir	Surface water	1 / month	17/10/2002	0.07
Kerbellec	Surface water	2-3 / year	22/10/2002	0.07 *
Noyelles sous Bellonne	Groundwater	1 / year	09/07/2002	0.1
Lens cité 14	Groundwater	?	22/11/2002	0.2
Hulluch	?	?	07/09/2002	1.7
Lagnicourt	?	?	16/07/2002	0.1
Inchy Beaumont en Cis	?	?	19/07/2002	0.2
2003				
Moussay	Groundwater	1 / month	07/01/2003	0.3
Yport	Groundwater	1 / month	02/04/2003	0.11
Droisy	Groundwater	2 / year	07/04/2003	0.13
Les Morvents	Groundwater	1 / month	08/04/2003	0.11
Saint Christophe sur Avre	Groundwater	?	09/04/2003	0.37
Morvillars	Groundwater	1 / month	02/06/2003	9.3
Leval 1	Groundwater	1 / week	07/07/2003 16/09/2003	4.7 1.3
Vallée du Cailly	Groundwater	1 / year	06/08/2003	0.2
Réchésy	Groundwater	?	01/09/2003	1
Faverois	Groundwater	?	01/09/2003	2
Lepuis Neuf	Groundwater	?	01/09/2003	1.5
Belfort	Groundwater	?	06/10/2003	1.4
Unknown **	?	?	20/06/2003	0.7
Ligny en Cambresis	?	?	20/11/2003	0.9
Levées des Tuileries	?	?	16/12/2003	0.1

Notes: ? = no information * raw water before treatment ** site no longer in use

The drinking water report 2002 - 2004 for France (Ministère de la Santé et des Solidarités, 2002 - 2004) presents water quality data for 2000 - 2002. With respect to the pesticides parameter, the report states that over 24 000 samples were taken from almost 7 000 treatment works, delivering a total of about 13 million m^3 of water, and resulting in 566 400 analyses for pesticides and metabolites. On average non-compliance with the pesticides parameter was found in 1% of the total number of analyses, or 17.7% in terms of the total number of samples taken. Non-compliance varied considerably with the size/capacity of the treatment works, with the lowest percentage (0.04% of analyses non-compliant) in works delivering ≥ 100 000 million m^3; and the highest failure rates (2.04% of analyses) at works delivering less than 100 million m^3 of drinking water. This observation is not surprising, as the higher capacity works are likely to have more complex treatment processes in place.

Glyphosate and AMPA were not mentioned among those exceeding the 0.1 $\mu g\ l^{-1}$ limit. Exceedances of the standard were dominated by the triazines and their metabolites, together accounting for 94.4% of all exceedances. The remaining 7.6% were related to 'other substances' but these were not specified, presumably because any exceedances were not significant, i.e. not requiring improvement measures.

However, in the raw water sources (destined for drinking water supplies) glyphosate accounted for 2.9% of all samples exceeding the drinking water limit of 0.1 $\mu g\ l^{-1}$ for pesticides and metabolites in the period 2000 - 2002; this compared with nine other pesticides and metabolites ranging from 2.2% (hexachlorobutadiene and des-isopropylatrazine) to 31.3% (atrazine) of the total 'exceedances'. There is no mention of AMPA which is probably not considered a relevant metabolite.

The standards for pesticides / relevant metabolites in raw waters destined for drinking water supplies were set at 2 $\mu g\ l^{-1}$ for individual substances and 5 $\mu g\ l^{-1}$ for total substances (Ministère de la Santé et des Solidarités, 2002 - 2004).

Exceedances of the pesticides parameter in drinking water in the period 1996 -1998 (Ministère de la Santé et de la Protection Sociale, 2003) were also dominated by the triazines. However, a table showed 17 pesticides and metabolites with at least one exceedance of the 0.1 $\mu g\ l^{-1}$ limit; glyphosate and AMPA were not among the substances listed.

Similarly an earlier report which includes pesticides data in drinking water from suppliers to more than 5 000 consumers in 1993-1995 does not mention any glyphosate or AMPA detections. The exceedances were again dominated by triazines, although another 18 substances were listed as having exceeded the 0.1 $\mu g\ l^{-1}$ standard (Direction Générale de la Santé, 1998).

5. GERMANY

The most recent available report (UBA, 2006) summarises the quality of drinking water (water for human consumption) in Germany, based on returns from all 16 Federal States (Länder) for the years 2002, 2003 and 2004.

The report covers treatment plants supplying on average more than 1000 m^3 per day or providing for a population of more than 5 000 (required to be reported under the EU Drinking Water Directive 98/83/EC – DWD). In total this amounts to 2 706 treatment plants across Germany, supplying some 60 million people (72.5% of the total population) with 4 112 million m^3 of drinking water per day. Of these 13.3% are derived from surface water, 76.2% from groundwater and 10.5% from other sources (e.g. bank filtrate or artificially recharged groundwater) (2004 data).

Tables are provided giving number of measurements for each parameter (separately ex treatment works and distribution system / consumers' taps), number with exceedance of specific parameters, including pesticides (single pesticide at 0.1 $\mu g\ l^{-1}$ and / or total pesticides at 0.5 $\mu g\ l^{-1}$). A separate table lists all parameters for which time-limited exemptions have been granted under Article 9 of the DWD, giving details of permitted concentrations, reasons for the exemptions, etc. (summarised for the period 2002-2004). Further tables list all substances with short-term exceedances not subject to exemptions, in some cases exceeding the standard on only one occasion (separate tables for each year). All these tables include a small number of pesticides and metabolites.

The information is summarised in **Table 5.1**. There were some exceedances of the pesticides parameter (individual and total pesticides), ranging from 0.73 – 1.60 % of all samples analysed. However, none relate to glyphosate (or AMPA), as shown in **Table 5.2**, which lists all substances reported to have exceeded the pesticides standard, either in the long-term and subject to exemptions, or short-term / occasional exceedances only. The reported exceedances were attributed to unlawful or inappropriate pesticide applications.

Table 5.1 Drinking water quality data for Germany, 2002 - 2004 (source: UBA, 2006)

Year	Pesticides parameter	Number of samples analysed	Number non-compliant	Percentage non-compliant
2004	Individual pesticides - 0.1 $\mu g\ l^{-1}$	10 620	155	1.46 %
	Total pesticides - 0.5 $\mu g\ l^{-1}$	6 069	41	0.73 %
2003	Individual pesticides - 0.1 $\mu g\ l^{-1}$	13 933	119	0.85 %
	Total pesticides - 0.5 $\mu g\ l^{-1}$	5 155	39	0.76 %
2002 *	Individual pesticides - 0.1 $\mu g\ l^{-1}$	3 246	52	1.60 %

Note: * Total pesticides not reported for 2002

Table 5.2 Pesticides and metabolites listed as non-compliant in Germany, 2002-2004, with or without exemptions (source: UBA, 2006)

Substance	With exemptions	Without exemptions		
		2002	2003	2004
2,6-Dichlorobenzamide (BAM – metabolite of dichlobenil)	✓	✓	✓	-
Atrazine	✓	✓	-	-
Desethylatrazine	✓	✓	✓	✓
Ethidimuron	✓	✓	-	-
Prochloraz	-	✓	-	-

However, it is not known how much monitoring was undertaken specifically for glyphosate and AMPA; the latter may not be considered a 'relevant metabolite', although it is highly likely that at least glyphosate would have been monitored if present in the raw water intake. The German drinking water regulations state in relation to the pesticides parameter that those pesticides (and relevant metabolites) likely to be present need to be monitored (TrinkwV, 2001 – Anlage 2). The Guidance providing health based values for drinking water in Germany (BfR, 2008) lists a value for glyphosate of 1000 µg l^{-1}, set in 2007 and based on an ADI (Acceptable Daily Intake) of 3 mg/kg body weight per day. The Guidance focuses on active ingredients; metabolites, such as AMPA are not included.

Data from a large water supplier (AWWR) in the Ruhr area, producing about 300 million m^3 /a of drinking water, shows that neither glyphosate or AMPA are found in drinking water, even when they are present in the raw water (surface water derived from the river Ruhr) (Schlett *et al.*, 2005). Examples for two treatment works are shown in **Tables 5.3 and 5.4**. It is clear that glyphosate and AMPA were removed at the early stage of treatment (artificial recharge / sand filtration) and therefore no longer detected in the treated water. Dr Schlett confirmed that glyphosate and AMPA are no longer monitored in drinking water at AWWR, because they have never been detected (Dr. Schlett, personal communication, 2008).

Table 5.3 Glyphosate and AMPA in raw water and treated water at Hengsen waterworks in 2005 (source: Schlett *et al.*,)

Sampling point	Parameter	Number of samples	Concentration (µg l^{-1})	
			minimum	maximum
Raw water intake (river Ruhr)	Glyphosate	13	< 0.05	0.09
	AMPA	13	< 0.08	1.10
After artificial recharge (slow sand filtration, underground passage)	Glyphosate	13	< 0.08	< 0.08
	AMPA	13	< 0.08	< 0.08

Table 5.4 Glyphosate and AMPA in raw water, partially treated water and final drinking water at Styrom-Ost waterworks in 2005 (source: Schlett *et al.*, 2005)

Sampling point	Parameter	Number of samples	Concentration ($\mu g\ l^{-1}$)	
			minimum	maximum
Raw water intake (river Ruhr)	Glyphosate	75	< 0.05	0.19
	AMPA	75	< 0.08	0.70
After sand filtration	Glyphosate	65	< 0.08	< 0.08
	AMPA	52	< 0.08	< 0.08
Final treated water	Glyphosate	54	< 0.08	< 0.08
	AMPA	54	< 0.08	< 0.08

6. IRELAND

In Ireland, sanitary authorities are requested to report compliance against the total pesticide parametric value and also to send to the EPA (Environmental Protection Agency), details of all individual pesticides found above the limit of detection. A review of the Irish EPA reports on the quality of drinking water in Ireland (http://www.epa.ie) for the years 2002 - 2006, has shown that there have been only three failures of single samples of drinking water to meet the total pesticides standard in 2004; two in 2005 and two in 2006. The number of samples analysed for pesticides over the years are reported in **Table 6.1** below. However, the results for the years 2002 - 2003 cannot be taken as representative of compliance nationally as there was only very limited monitoring of pesticides.

Table 6.1 Total number of water supply zones (WSZ) monitored and samples analysed for pesticides parameters in Ireland during the period 2002 - 2006 (from EPA 2003, 2004, 2005, 2006 and 2007)

Year	Number of WSZ monitored	Number of WSZ with exceedances	Number of samples analysed	Number of samples where pesticides were detected	Number of samples where individual concentrations exceeded 0.1 µg l^{-1}	Number of samples where total concentrations exceeded 0.5 µg l^{-1}
2002	NI	NI	4 a)/12 b)	NI	0	0
2003	NI	NI	0 a)/55 b)	NI	0	0
2004	465	3	707	NI	NI	3
2005	795	2	1275	197	9	2
2006	880	2	1342	190	11	2

Notes:
NI = no information
a) individual pesticides
b) total pesticides = the sum of analysis of all individual pesticides

The pesticides detected in water supplies in 2005 and 2006 are shown in **Table 6.2.** There was no detailed information for 2004. There were no reports of any glyphosate or AMPA detections.

Table 6.2 Summary of pesticides detected in Irish water supplies in 2005 and 2006 (from EPA 2006 and 2007)

Pesticide	2005		2006	
	Number of samples where pesticide detected	Number of samples >0.1 µg l^{-1}	Number of samples where pesticide detected	Number of samples >0.1 µg l^{-1}
Atrazine	128	2	100	1
Simazine	98	2	86	1
Dichlobenil	29	3	29	
Terbuthylazine			19	
MCPA	15		16	3
Mecoprop	22		15	
2,4-D	38		10	
Triclopyr	4		10	
Methoxychlor			9	5
Tebucanazole			9	
Trietazine			7	
DDD p,p			6	
Diuron			6	
Triadmefon			6	
Isoproturon			4	
Lindane	2		3	
Chlorpropham			2	
DDT p,p			2	
Hexachlorobenzene			2	
Malthion			2	1
Propazine	4		2	
2,4-D			1	
Bromoxynil	23		1	
Bromocil	2			
2,3,6 TBA	2			
Clopyralid			1	
DDE p,p			1	
Dieldrin	1		1	
Parathion-ethyl			1	
Heptachlor epoxide	1			
Heptachlorobenzene	1			
Pentachlorophenol	1	1		
Metazachlor	1	1		
Chlorothalonil	1			
Unspecified			23	

7. SPAIN

Drinking water quality in Spain has been reported for the years 2002, 2003 and 2004 by the Ministry of Health and Consumers (Ministero de Sanidad y Consumo, undated).

The monitoring programme includes a large number of pesticides and some metabolites (112 substances are listed), but does not include glyphosate or AMPA. The report does not provide any information on the selection criteria for pesticides monitoring, although it would normally be expected that monitoring should focus on those substances likely to be present, e.g. on the basis of usage in the catchment and/or occurrence in raw waters abstracted for drinking water supplies.

The pesticides compliance data are summarised in **Table 7.1**. Non-compliance affected a small proportion of samples (0.04% on average over the three years, with the highest proportion in 2002), and were due to atrazine in 2003 and 2004, azinphos-methyl in 2003, and propazine and terbutylazine in 2004. The maximum concentration of 0.24 µg l^{-1} in 2003 was due to azinphos-methyl, and the maximum concentration of 33.9 µg l^{-1} in 2004 was due to propazine.

Table 7.1 Compliance with the individual pesticides parameter of 0.1 µg l^{-1} in Spain, 2002 – 2004 (source: Ministero de Sanidad y Consumo, undated)

Year	Number of analyses	Compliant (< 0.1 µg l^{-1})		Non-compliant (> 0.1 µg l^{-1})		Maximum concentration
		Number	%	Number	%	(µg l^{-1})
2002	15 948	15 918	99.81	30	0.19	?
2003	17 935	17 933	99.99	2	0.01	0.24
2004	56 511	56 503	99.99	8	0.01	33.9
Total 02-04	**90 394**	**90 354**	**99.95**	**40**	**0.04**	**33.9**

8. SWEDEN

Glyphosate and AMPA data for drinking water in the years 2000-07, as obtained from the pesticides database at the Swedish University of Agricultural Sciences (SLU) (link kindly provided by Stina Adielsson, SLU, Dep. Soil Sciences, Div. Water Quality Management, Uppsala, personal communication, 2008), are shown in **Table 8.1** and **Table 8.2,** respectively. The data have been collated from the different regions across Sweden and are likely to vary considerably in terms of monitoring and analytical methodologies, reliability and limits of detection.

Table 8.1 Glyphosate in Swedish drinking water, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Region Code	Number of samples analysed	Number (%) of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
AB	41	0	-	-	-
AC	127	0	-	-	-
BD	83	0	-	-	-
C	196	0	-	-	-
D	105	0	-	-	-
E	112	0	-	-	-
F	202	0	-	-	-
G	112	0	-	-	-
H	79	0	-	-	-
K	76	0	-	-	-
M	431	5 (1.16)	0.170	0.021	0.001
N	25	0	-	-	-
O	259	1 (0.39)	0.035	0.035	0.000
S	130	1 (0.77)	0.020	0.020	0.000
T	24	0	-	-	-
U	30	0	-	-	-
W	118	0	-	-	-
X	128	0	-	-	-
Y	181	0	-	-	-
Z	9	0	-	-	-
Total / maximum	**2 468**	**7 (0.28)**	**0.170**	**0.035**	**0.001**

Overall 2 468 drinking water samples were analysed for glyphosate, which was detected in a total of seven samples (or 0.28% of samples), with the maximum concentration at 0.17 µg l^{-1}. AMPA was analysed in a total of 2 428 samples and detected in 14 (0.58%) samples, with the maximum concentration at 0.680 µg l^{-1}.

Table 8.2 AMPA in Swedish drinking water, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Region Code	Number of samples analysed	Number (%) of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
AB	40	0	-	-	-
AC	127	0	-	-	-
BD	83	0	-	-	-
C	192	0	-	-	-
D	105	0	-	-	-
E	112	0	-	-	-
F	200	0	-	-	-
G	112	0	-	-	-
H	78	0	-	-	-
K	76	0	-	-	-
M	414	8 (1.93)	0.680	0.059	0.003
N	25	0	-	-	-
O	259	0	-	-	-
S	129	1 (0.78)	0.020	0.020	0.000
T	23	0	-	-	-
U	30	0	-	-	-
W	118	0	-	-	-
X	115	5 (4.35)	0.350	0.130	0.007
Y	181	0	-	-	-
Z	9	0	-	-	-
Total / maximum	**2,428**	**14 (0.58)**	**0.680**	**0.059**	**0.003**

The single sample detections of glyphosate in Regions “O” and “S” were in 2002 and 2005, respectively, whilst the five detections in Region “M” were observed between 2001 and 2006; details are shown in **Table 8.3**. It is clear from these details that only three of the results were at or above 0.1 µg l^{-1}, one in 2004 and two in 2006, respectively. Similarly the AMPA detections, one in Region “S” and five in Region “X” were all in 2005, whereas the eight detections in Region “M” were observed between 2001 and 2006, as shown in **Table 8.4**. For both glyphosate and AMPA the highest concentrations were found in 2004 and 2006, and they were not detected in 2007, although the number of samples analysed was considerably less.

Table 8.3 Glyphosate detection in drinking water in Region M, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Year	Number of samples analysed	Number of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
2007	15	0	-	-	-
2006	144	2	0.170	0.120	0.002
2005	123	1	0.010	0.010	0.000
2004	66	1	0.100	0.100	0.002
2003	37	0	-	-	-
2002	11	0	-	-	-
2001	19	1	0.021	0.021	0.001
2000	6	0	-	-	-

Table 8.4 AMPA detection in drinking water in Region M, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Year	Number of samples analysed	Number of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
2007	11	0	-	-	-
2006	144	4	0.200	0.059	0.003
2005	120	0	-	-	-
2004	66	2	0.680	0.030	0.011
2003	30	0	-	-	-
2002	1	1	0.020	0.020	0.020
2001	13	1	0.210	0.210	0.016
2000	6	0	-	-	-

It is worth noting that the pattern of glyphosate and AMPA detections in drinking water is very similar to that observed in groundwater (see **Table 8.5** and **Table 8.6** for glyphosate, and **Table 8.7** for AMPA), with most of the detections obtained in Region "M", and interestingly the maximum concentrations for Glyphosate and AMPA being identical values (and observed in the same year), although the total number of detections was lower for drinking water. This could indicate that the small number of drinking water detections originated from untreated groundwater, perhaps from contaminated wells for small supplies, similar to some small supplies in Denmark (see **Section 3,** Brüsch and Rosenberg, 2008)? However, further details of these samples were not available, but it may be useful to seek clarification, such as further details of the sampling sites, dates, type of groundwater (shallow?) and geological conditions (fissured aquifer, rapid transport from surface run-off), drinking water treatment and supplies (public versus small/private wells), etc.

Table 8.5 Glyphosate in Swedish groundwater, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Region Code	Number of samples analysed	Number (%) of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
AB	41	0	-	-	-
AC	143	0	-	-	-
BD	94	0	-	-	-
C	231	1 (0.43)	0.020	0.020	0.000
D	111	0	-	-	-
E	82	0	-	-	-
F	188	0	-	-	-
G	85	0	-	-	-
H	88	0	-	-	-
I	65	0	-	-	-
K	70	0	-	-	-
M	766	9 (1.17)	0.170	0.100	0.001
N	81	0	-	-	-
O	240	4 (1.67)	0.080	0.030	0.001
S	132	2 (1.52)	0.085	0.020	0.001
T	24	0	-	-	-
U	30	0	-	-	-
W	118	0	-	-	-
X	128	0	-	-	-
Y	181	0	-	-	-
Z	9	0	-	-	-
Total / maximum	**3,053**	**16 (0.52)**	**0.170**	**0.100**	**0.001**

Table 8.6 Glyphosate detection in groundwater in Region M, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Year	Number of samples analysed	Number of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
2007	20	0	-	-	-
2006	192	2	0.170	0.120	0.002
2005	198	1	0.010	0.010	0.000
2004	118	2	0.110	0.100	0.002
2003	61	0	-	-	-
2002	85	2	0.100	0.080	0.002
2001	45	2	0.140	0.021	0.001
2000	47	0	-	-	-

Table 8.7 AMPA in Swedish groundwater, 2000 - 2007 (source: SLU Pesticides Database, 2008, http://pesticid.slu.se)

Region Code	Number of samples analysed	Number (%) of samples detected	Maximum concentration µg l^{-1}	Median concentration µg l^{-1}	Average concentration µg l^{-1}
AB	38	0	-	-	-
AC	143	0	-	-	-
BD	94	0	-	-	-
C	223	1 (0.43)	0.020	0.020	0.000
D	111	0	-	-	-
E	82	0	-	-	-
F	188	0	-	-	-
G	85	0	-	-	-
H	89	0	-	-	-
I	65	0	-	-	-
K	70	0	-	-	-
M	745	11 (1.48)	0.680	0.059	0.002
N	81	0	-	-	-
O	237	0	-	-	-
S	131	1 (0.76)	0.020	0.020	0.000
T	28	1 (2.73)	0.010	0.010	0.000
U	52	0	-	-	-
W	171	0	-	-	-
X	173	5	0.350	0.130	0.005
Y	189	0	-	-	-
Z	9	0	-	-	-
Total / maximum	**2 999**	**14 (0.47)**	**0.680**	**0.130**	**0.005**

9. THE NETHERLANDS

In the Netherlands, a high proportion of drinking water is derived from surface water or indirectly from bank filtrate. The drinking water regulations in the Netherlands (Waterleidingsbesluit of 7 June 1960, as amended) also include surface water quality criteria in relation to treatment requirements. Therefore, although glyphosate is likely to be removed during drinking water treatment (Schlett *et al*., 2005, Hall and Camm, 2007), it is considered particularly relevant to know its occurrence in water intakes.

It may also be worth noting that the pesticides database for surface waters in the Netherlands (Pesticides Atlas, 2007) lists glyphosate as second among the top ten pesticides exceeding the drinking water limit of 0.1 µg l^{-1} in surface water, whereas it is not listed among the top ten as analysed against the Dutch Pesticide Authorisation Standard or the Maximum Tolerable Risk Standard.

Whilst the Dutch have traditionally been very concerned about the inclusion of pesticide degradation products in drinking water and surface water regulations, they have declared AMPA as a toxicologically non-relevant metabolite and therefore not subject to the 0.1 µg l^{-1} standard for drinking water (as stated in the drinking water quality report for 2001: Versteegh and Biesebeek, 2003; also on the CTB website - databank under Roundup DRY, registration no. 11229N). The drinking water quality report for 2002 (Versteegh and Biesebeek, 2004) also includes a statement that up to 500 µg l^{-1} AMPA in drinking water would have no toxicological significance to human health, whilst WHO did not deem it necessary to establish guideline values for glyphosate or AMPA, as these were not considered to pose a hazard to human health under normal conditions if present in drinking water (WHO, 2003; estimated health-based value for AMPA: 900 µg l^{-1}).

For glyphosate one exceedance of the drinking water standard has been reported each in 2005 and 2006. The data are summarised in **Table 9.1**. It seems somewhat surprising that on both occasions the samples with glyphosate >0.1 µg l^{-1} were derived from the distribution network, yet no exceedances were found in samples taken at treatment works, though this might confirm the short-lived nature of its presence. In any case, since these were isolated exceedances (one sample only in each case), no further action, such as remedial measures, were deemed necessary (Versteegh and Dik, undated and 2007). All reports from 2000 - 2006 (Versteegh and others, 2002 - 2007, and undated) were examined; no exceedances were reported in the years 2000 - 2004. Detections below the drinking water standard of 0.1 µg l^{-1} are reported only where exceedances occur. Exemptions / measures to remove a contaminant are not required if exceedances of the standard are for a period of less than 60 days' duration (Versteegh and Dik, 2006).

Table 9.1 Glyphosate detection in drinking water in the Netherlands, 2000 - 2006 (source: Drinking water quality reports 2000 - 2006, Versteegh and others, 2002 - 2007 and undated)

Year	Source water	Number of detections	Minimum ($\mu g\ l^{-1}$)	Average ($\mu g\ l^{-1}$)	Maximum ($\mu g\ l^{-1}$)	Number >0.1 $\mu g\ l^{-1}$
2006	Groundwater	7	<0.05	0.06	0.43	1
2005	Surface water (River Maas)	7	<0.05	0.07	0.37	1

Note: no exceedances reported in the years 2000-2004

Since the drinking water quality reports include data for glyphosate and AMPA at water intakes, these are also summarised in **Tables 9.2 and 9.3**. It is clear from these data that glyphosate and AMPA were detected in a number of samples and frequently above the drinking water standard at surface water intakes for drinking water supplies in the years 2000 - 2006. In spite of this, only two exceedances (one each in 2005 and 2006) were found in the final drinking water supplies, suggesting that the substances were removed effectively during drinking water treatment. (AMPA in drinking water may not have been reported because it is not considered a relevant metabolite and therefore not subject to the limits set for the pesticides parameter).

An early publication (Puijker and Janssen, 1999) indicates that some of the water companies reported that glyphosate and AMPA were removed during dune filtration or other treatment techniques, although occasional AMPA concentrations above 0.1 $\mu g\ l^{-1}$ were detected in drinking water (see also information from Germany, Schlett *et al.*, 2005).

Table 9.2 Glyphosate detection in raw water intakes (surface water) in the Netherlands (source: Drinking water quality reports 2000 - 2006, Versteegh and others, 2002 - 2007 and undated)

Year	Water supplier / waterworks	Number of detections	Minimum ($\mu g\ l^{-1}$)	Average ($\mu g\ l^{-1}$)	Maximum ($\mu g\ l^{-1}$)
2006	WGron / De Punt	13	<0.05	<0.05	0.15
	Waternet / WRK I + II	26	<0.05	0.07	0.43
	Waternet / Amsterdam Rijn Kanaal	26	<0.05	<0.05	0.14
2005	WGron / De Punt	8	<0.10	<0.10	0.11
	WLB / WRK I + II	13	<0.05	0.07	0.36
	WLB / Amsterdam Rijn Kanaal	13	<0.05	<0.05	0.14
	Evides / Brabantse Biesbosch	13	<0.10	<0.10	0.20
2004	WLB / Amsterdam Rijn Kanaal	7	<0.05	<0.05	0.15
	Evides / Brabantse Biesbosch	18	<0.05	0.22	0.45
2003	WRK / WRK I + II	4	<0.05	0.10	0.22
	WBB / Brabantse Biesbosch	13	<0.05	0.18	0.38
2002	PWN / Andijk	13	<0.05	0.14	0.25
2001	PWN / Andijk	8	<0.05	0.08	0.14
2000	GWA / Amsterdam Weesperkarspel	1	-	-	0.15
	WBB / Brabantse Biesbosch	13	<0.05	0.07	0.15

Notes: Some changes in suppliers' names over the years
- not relevant

Table 9.3 AMPA in raw water intakes (surface water) in the Netherlands (source: NL drinking water quality reports 2000 - 2006, Versteegh and others, 2002 - 2007 and undated)

Year	Water supplier / waterworks	Number of detections	Minimum (μg l^{-1})	Average (μg l^{-1})	Maximum (μg l^{-1})
2006	PWN / Andijk	26	<0.1	0.22	0.83
	Waternet / WRK I + II	26	0.11	0.38	0.87
	Waternet / Weesperkarspel	13	<0.1	0.1	0.14
	Waternet / Amsterdam Rijn Kanaal	26	<0.0	<0.4	0.89
	Evides / Brabantse Biesbosch	13	<0.05	0.67	1.4
2005	WGron / De Punt	13	<0.05	<0.05	0.18
	PWN / Andijk	12	0.10	0.26	0.54
	WLB / Weesperkarspel	3	<0.10	0.18	0.37
	WLB / WRK I + II	13	0.13	0.43	1.00
	WLB / Amsterdam Rijn Kanaal	13	<0.10	0.46	0.64
	Evides / Brabantse Biesbosch	13	<0.10	0.42	1.20
2004	PWN / Andijk	7	0.15	0.72	2.5
	WLB / Weesperkarspel	3	<0.1	0.18	0.37
	WLB / WRK I + II	11	0.13	0.61	1.00
	WLB / Amsterdam Rijn Kanaal	7	0.11	0.48	0.94
	Evides / Brabantse Biesbosch	18	0.26	1.20	1.90
2003	PWN / Andijk	4	0.04	0.15	0.25
	WGron / Drentsche Aa	4	<0.07	0.07	0.22
	WLB / Weesperkarspel	3	<0.03	0.10	0.31
	WRK / WRK I + II	4	<0.05	0.34	0.65
	WBB / Brabantse Biesbosch	13	0.21	1.10	1.90
2002	PWN / Andijk	4	0.03	0.13	0.19
	WBB / Brabantse Biesbosch	13	0.15	0.18	0.82
2001	PWN / Andijk	7	0.10	0.19	0.27
	WBB / Brabantse Biesbosch	8	<0.03	0.43	0.92
2000	PWN / Andijk	7	0.06	0.14	0.24
	GWA / Amsterdam Weesperkarspel	1	-	-	0.4
	WBB / Brabantse Biesbosch	13	0.21	0.62	1.30

Notes: Some changes in suppliers' names over the years
- not relevant

10. UK

10.1 England & Wales

A review of the UK Drinking Water Inspectorate reports for the years 2000 - 2006 (DWI, 2000 - 2006), including details for regional reports, has shown that there have been only 4 failures of individual samples of drinking water to meet the pesticide standard for glyphosate, all in 2004 (**Table 10.1**), with no further failures in 2005 and 2006. Three of these failures were for one water company, and the DWI report states that these may have arisen through contamination within the laboratory. Glyphosate is therefore not considered to be among the pesticides of concern in relation to drinking water in England and Wales. For comparison, failures for other pesticides are included in **Table 10.2**; glyphosate failures represent 1.2% of the total number of pesticide failures.

Table 10.1 UK pesticide failures 2000 – 2006 (source: DWI reports for 2000 - 2006, http://www.dwi.gov.uk/reports.shtm)

Pesticide	Number of failures		
	2000 - 2004	2005	2006
MCPA	72	0	3
2,4-D	34	0	1
Mecoprop	31	4	3
Isoproturon	28	1	0
Propyzamide	22 (all in 2001)	0	0
Trietazine	16	9	0
Diuron	15	9	5
Atrazine	14	1	0
Carbetamide	13	0	0
Chlortoluron	13	1	2
Simazine	8	1	0
Glyphosate	4 (all in 2004)	0	0
Clopyralid	3	0	0
2,4,5-T	2	0	0
Carbophenothion	1	0	0
Metaldehyde	1	0	0
Chloridazon	1	0	0
Prochloraz	1	0	0
Dicamba	1	1	0
Trietazine	0	0	7
Asulam	0	0	1
Total number of failures 2001-2006	**280**	**27**	**22**

With respect to pesticides, the DWI requires those substances to be monitored which are likely to be present. Water companies are required to assess the risk to drinking water from pesticide use in their catchments and are also expected to keep up-to-date their list of pesticides used in the catchment for each source (DWI, 2006). With respect to metabolites, the Guidance on the Water Supply Regulations for England and Wales (DWI, 2005) places the focus of the term "relevant" on metabolites, degradation products and reaction products that have similar pesticidal properties to their parent pesticides. The document also indicates that there was no evidence at the time that any such substances, in respect of drinking water, presented a risk to health and therefore no additional monitoring was required, i.e. no monitoring of AMPA is required. The DWI has, however, included an update assessment of this policy in their current research programme (DWI, 2008).

10.2 Northern Ireland

The drinking water quality report from Northern Ireland (Environment & Heritage Service, 2007) lists individual pesticides which exceeded the pesticides standard in drinking water. This included glyphosate, which was detected on three occasions in 2004, once in 2005 and never in 2006. On each occasion it was at a different treatment plant, indicating no persistent contamination. It was also detected once in 2004 and once in 2006 in private supplies, but not in 2002, 2003 or 2005.

10.3 Scotland

The most recent available drinking water quality report for Scotland (DWQR, 2006) reports two failures of the pesticides parameters in drinking water samples taken from consumers' taps in 2005, out of almost 22 000 pesticide analyses. The substances concerned are not listed. Samples from raw water sources revealed no presence of pesticides above 0.1 µg l^{-1} (maximum value 0.03 µg l^{-1}), although the number of samples analysed was much smaller than for treated waters from the distribution system. The low presence of pesticides in water sources is attributed in the report to most drinking water sources being derived from upland catchments where agricultural activities are limited.

11. CONCLUSIONS

Whilst glyphosate and AMPA were reported present in water intakes in France, Germany and the Netherlands, no glyphosate exceedances of the individual pesticide standard for drinking water of 0.1 µg l^{-1} were reported from Belgium, Germany and Ireland. A small number of sporadic results > 0.1 µg l^{-1} have been reported from France (25 samples in the period 2001 - 2003), the Netherlands (two each in 2005 and 2006) and the UK (four in England & Wales in 2004, three in Northern Ireland in 2004 and one in 2005, as well as two in private supplies). All were isolated detections and none were considered significant, i.e. no reports of improvement measures being needed because of the presence of glyphosate in drinking water. Three of the four exceedances in England & Wales were attributed to probable problems with the analysis, due to the occasional occurrences; similar explanations may well apply to exceedances reported from elsewhere. Whilst there were no reported exceedances for glyphosate (or AMPA) in large public supplies in Denmark, there were some detections and exceedances in small private supplies. Special investigations revealed that all wells affected were abstracting shallow groundwater (probably supplied untreated) in conditions where there was rapid infiltration of surface water from nearby fields or run-off from treated court yards in the vicinity. A similar situation may be the case in Sweden, where a small number of glyphosate and AMPA detections and exceedances were found in drinking water; these seemed to be mainly derived from groundwater, but no further sample details were available.

Glyphosate and AMPA were not included in the list of 112 pesticides and metabolites monitored in drinking water in Spain; no selection criteria for pesticides monitoring were presented, although it would normally be expected that monitoring should focus on those substances likely to be found, e.g. on the basis of usage and occurrence in raw water sources.

Evidence of the effective removal of glyphosate and AMPA at early treatment stages (artificial recharge or bank filtration, sand filtration) was also obtained from a major water supplier in Germany. Other information also shows the effective removal of these substances by water treatment processes.

AMPA is not considered a relevant metabolite in the Netherlands or the UK, and therefore not reported in drinking water; it appears to be similarly treated in the other countries, although reported in France.

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