IMPLICATIONS OF THE REVISION OF THE DRINKING WATER DIRECTIVE

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IMPLICATIONS OF THE REVISION OF THE DRINKING WATER DIRECTIVE

EXECUTIVE SUMMARY

In 1995, the European Commission published a proposal for a revised Drinking Water Directive (Council Directive concerning the quality of water intended for human consumption). Negotiations on the proposal have started in the Council of Ministers. The proposed, revised Directive has the same standard for total polycyclic aromatic hydrocarbons (PAH) as the existing Directive 80/778/EEC, i.e. 0.2 $\mu g\ l^{-1}$ for the total of six specified PAH, but has introduced a separate standard for benzo(a)pyrene of 0.01 $\mu g\ l^{-1}$. The requirements for monitoring will be more stringent than in the present directive, but generally in line with UK practice; samples will be taken at consumers' taps.

Contraventions of the standard for total PAH are occasionally observed in the UK; these are due to leaching of PAH (mainly fluoranthene) from old coal tar lined pipes still in use in distribution systems. In order to estimate the extent of similar problems and awareness of them in other EU Member States, contact was made with trade associations, pipe manufacturers, research institutes, and representative, regional or local authorities and water suppliers in all EU Member States, though the efforts focused particularly on the larger countries, Germany, France, Italy, and Spain.

Overall there does not seem to be much concern in other EU Member States over compliance with the PAH parameter. This seems to be partly due to a lack of information in general, in part to lack of end-of-pipe monitoring of PAH in drinking water, and in part to limited use of coal tar lined mains in the past. Clear evidence of problems with PAH as a result of the use of coal tar lined pipes has been obtained only from Germany; France may have some problems, but data do not seem to be available. Belgium also seems to experience some difficulty and isolated incidents were mentioned in Spain.

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3. To establish the extent to which drinking water supplies in other Member States may give rise to contraventions of a standard of 0.2 $\mu g\ l^{-1}$ for the sum of the six PAH named in the present Drinking Water Directive and in the proposal for a revised Directive.

4. To establish the extent to which drinking water supplies in other Member States would be found to give rise to contraventions of a standard of 0.2 $\mu g\ l^{-1}$ for the sum of the six PAH named in the present Drinking Water Directive and in the proposal for a revised Directive, if samples were taken at consumers' taps.

5. To establish which PAH give, or would give rise to contraventions.

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3. INTRODUCTION

In 1995, the European Commission published a proposal for a revised Drinking Water Directive (Council Directive concerning the quality of water intended for human consumption). Negotiations on the proposal are likely to start in the Council of Ministers in the near future.

The proposed, revised Directive has the same standard (parametric value) for total polycyclic aromatic hydrocarbons (PAH) as the existing Directive 80/778/EEC, i.e. 0.2 $\mu g\ l^{-1}$ for the total of six specified PAH, but has introduced a standard for benzo(a)pyrene of 0.01 $\mu g\ l^{-1}$. The six specified PAH are as follows:

- Fluoranthene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(a)pyrene
- Benzo(ghi)perylene
- Indeno(1,2,3-cd)pyrene.

Although the standard for total PAH is based on World Health Organisation (WHO) Guideline Values (GV) for drinking water published in 1970 (WHO 1970) and 1971 (WHO 1971), it is not a health-based standard. The GV for benzo(a)pyrene was based on health considerations (WHO 1984), but this GV has been raised to 0.7 $\mu g\ l^{-1}$ in the recent revision of the WHO Guidelines (WHO 1993). No Guideline Values were recommended in the 1993 edition for any other PAH, due to lack of toxicity data. The occurrence and toxicity of PAH has been reviewed recently by Young (1994).

PAH are found in drinking water mainly as a result of leaching from distribution pipes lined with coal tar pitch. Such pipes have been used widely in the past in the UK, but their installation was discontinued in the nineteen-seventies. Many old coal tar lined pipes have been replaced or relined over the years, though some are still in use today. Of the six PAH listed in the Directive, fluoranthene is the most frequently detected and found at the highest concentrations, though not at concentrations which would be considered of concern in terms of health risks to consumers. PAH leaching from coal tar lined pipes can be related to the state of the lining, water temperature, residual disinfectant, other water quality parameters, e.g. hardness, and residence time (Ainsworth *et al.* 1996, De Rosa and Crane 1993, De Rosa *et al.* 1992). In contrast, bitumen, which has been used as an alternative to coal tar pitch for lining pipes, has a much lower PAH content, and does not normally give rise to detectable PAH concentrations in drinking water (de Rosa and Crane 1993).

Although the parameter for total PAH remains unchanged in the proposed, revised Directive, there are changes in the monitoring requirements which could affect compliance with the parameter in a number of European countries. The revised Directive requires 'values to be respected at the point where water for human consumption is available to the consumer' (i.e. the tap). However, monitoring for PAH was formerly left to the discretion of Member States, so this parameter may not have been monitored regularly in all countries.

In the UK, where water quality is mainly monitored at consumers' taps and the analysis has to be carried out using methods which extract both soluble and particulate PAH (DoE 1989 and The Environment Agency 1997), there are some problems in achieving full compliance with the total PAH parameter. DWI reported 87.3% of zones meeting the standard in 1995, following a decrease in this figure each year since 1991, though this decrease in compliance was largely attributed to developments in monitoring techniques, and possibly to disturbance of pipe deposits during cleaning (DWI 1996).

Where water supply companies fail to meet standards, they are obliged to take remedial action, for example by replacement or re-lining of pipes. This can be a costly exercise and may be of doubtful benefit to consumers, in view of the strict standards which are not justified in terms of health risk. Raising the standards in line with acceptable health criteria may provide a justifiable alternative.

Similar problems with compliance, especially after adoption of the proposed, revised Directive, are likely to be encountered in other Member States of the European Union (EU) if coal tar lined pipes have been installed and are still in use, as is the case in the UK.

In order to estimate the extent of problems and awareness of them in other EU Member States, contact was made with trade associations, pipe manufacturers, research institutes, and representative, regional or local authorities and water suppliers in all EU Member States, though attempting to focus particularly on the larger countries, Germany, France, Italy, and Spain.

4. OVERVIEW OF THE USE OF COAL TAR LINED PIPES AND PAH MONITORING OF DRINKING WATER IN MEMBER STATES OF THE EUROPEAN UNION

Overall there does not seem to be much concern in other EU Member States over compliance with the PAH parameter. This seems to be partly due to a lack of information in general; in part, to lack of end-of-pipe monitoring of PAH in drinking water, and in part to limited use of coal tar lined mains in the past. Several countries have not used these at all, others have used them, but to a lesser extent than in the UK and many have replaced or relined by now. The only Member State, where coal tar has clearly been used as extensively as in the UK, is Germany. Table 4.1 summarises the information obtained for all Member States (including the UK) with respect to use of coal tar lined pipes in the past, their discontinuation of use and reasons for the latter, where known. It does seem that, with the exception of Germany, coal tar lining was used less extensively than in the UK, and where used, abandoned earlier than in the UK. To some extent this appears to be linked to the availability of coal tar, as was clearly seen in the case of the former Eastern Germany, a brown coal area where coal tar was not produced and, consequently, not used as pipe lining material. Generally, cement mortar lining seems to have been used much more in continental Europe, and mainly without sealing materials.

It was very difficult to obtain monitoring data from other Member States for PAH in drinking water sampled at consumers' taps, although some interesting information has been obtained. The difficulty was again due, partly to a complete lack of appropriate data, and partly to confidentiality or merely inaccessibility of the data. Clear evidence of problems with PAH as a result of the use of coal tar lined pipes has only been obtained for Germany; France may have some problems, but data do not seem to be available. Belgium also seems to experience some problems and isolated incidents were mentioned in Spain, but no data are available. The information obtained for all Member States on PAH monitoring is summarised in Table 4.2.

Another difficulty in obtaining appropriate information was due to confusion of terminology. Although the terms for 'coal tar' and 'bitumen' have been established for the major European languages (see Appendix A), professionals concerned with water supply and water quality were not always entirely clear about the difference and sometimes used the terms interchangeably.

To summarise, there clearly are problems with PAH in drinking water in Germany, though this is not officially acknowledged. Coal tar lined pipes were used very extensively (30 to 60% of mains), but the amount is decreasing due to replacement/relining programmes. There seem to be considerable problems with respect to PAH whenever a survey is conducted. However, in most cases, the problems seem to remain undetected, since official analyses are carried out on samples from treatment works. Consequently PAH is not generally recognised as a significant problem, although the issue has been raised in the parliament of the State of Baden-Württemberg. Moreover, the Federal Authorities

(Ministry of Health - Bundesgesundheitsamt BGA) have recommended that a short-term limit of 700 ng l^{-1} for 'carcinogenic' PAH can be justified in unavoidable cases (Landtag von Baden-Württemberg, 1994); this also suggests that there are problems of compliance at times.

Table 4.1 Use of Coal Tar Lined Pipes

Country	Use of coal tar lined pipes	Date new installation ceased	Reasons for discontinuing use of coal tar lines pipes
Austria	Never used (small proportion of bitumen lined pipes may be in use)	-	-
Belgium	Used in the past, but no indication of the extent	1940s	physical, biofilm and organoleptic problems
Denmark	Some used in the past	Unknown	-
Finland	Relatively small amounts used in past but, due to aggressive waters, probably no lining left	-	most large distribution systems relatively new, extensive use of plastic pipes
France	Used in the past	1960	Taste and odour problems in chlorinated water, detachment of lining
Germany	Used extensively, estimated 30-60% of mains, depending on supply	1972-1975	Health concern (PAH)
Greece	Limited use in the past	No longer used (not known when new installation discontinued)	Unknown
Ireland	Used in the past, and possibly some remaining in use	Mid 1970s	Cement lined ductile iron used instead
Italy	Unknown (probably not used extensively)	-	-
Luxembourg	Never used	-	-
The Netherlands	Used by one water supplier only, but all replaced	early 1980s	Use of coal tar and bitumen in contact with drinking water banned
Portugal	Unknown, but not thought to have been used extensively	No longer used	Unknown
Spain	A relatively small amount used in the past	1960 or earlier	Scale build-up
Sweden	Never used	-	-
England and Wales	Used extensively in the past, >2%* still in use	1977	Health concern (PAH)

* based on lengths defined for rehabilitation for recent DoE study (Buckland *et al.* 1996).

Table 4.2 Monitoring of PAH in Drinking Water

Country	PAH monitoring (Yes/No)	Sampling location	Data obtained (Yes/No)	Concentrations found (Contravention of standard)	Concern by authorities (Yes/No)
Austria	Yes	Distribution network	No	Always below detection limit	No
Belgium	Yes	Treatment works, distribution system and 20% at consumers' taps	No	Rare incidents	No
Denmark	No	-	No	-	No
Finland	Yes	Distribution system	No	Usually below detection limit	No
France	Yes	Occasionally in distribution system, public drinking fountains and consumers' taps	Yes	one contravention reported (460 ng l^{-1} fluoranthene)	Unknown
Germany	Yes	Treatment works (some surveys in distribution systems)	Yes	Some high levels and contraventions (fluoranthene)	No
Greece	Unknown	-	No	Unknown	Unknown
Ireland	No	-	No	-	No
Italy	Some	Distribution systems, consumers' taps	Yes	Very low levels found	No
Luxembourg	Unknown	-	No	-	No
The Netherlands	Yes	Raw and treated at treatment works	Yes	Usually below detection limit or below EU standard	No
Portugal	Unknown	-	No	Unknown	No
Spain	Yes	Consumers' taps (public buildings)	No	Unknown (isolated incidents)	Unknown
Sweden	Yes - up to 3 years ago	Raw Treated Consumers' taps	No	No	No
England and Wales	Yes	Customers' taps	Yes	Contraventions in 12.7% of zones in 1995	Yes

5. USE OF COAL TAR LINED PIPES AND PAH MONITORING OF DRINKING WATER IN INDIVIDUAL MEMBER STATES

5.1 Austria

5.1.1 Summary

At official level, where drinking water quality is monitored, there is not expected to be any difficulty in meeting the PAH parameter of the existing or the revised EU Drinking Water Directive. Coal tar lined pipes do not appear to have been used and PAH monitoring results for drinking water samples taken in the distribution system were said to be always below detection limit.

5.1.2 Use of coal tar lined pipes

Coal tar lined pipes do not appear to have been used at any time in Austria. Drinking water is derived from groundwater (99%); the water is non-aggressive and cement lined or unlined iron pipes are suitable. The most widely used, traditional material is asbestos cement. A small percentage of bitumen lined pipes may be in use; bitumen has been approved for use in contact with drinking water under the Food Law.

5.1.3 Monitoring of PAH in drinking water

Raw water quality is governed by the Water Law, whereas drinking water quality is subject to the Food Law and samples for analyses must be taken from the distribution network. Routine monitoring of drinking water quality includes PAH, although the full set of drinking water parameters that are not considered to be a problem, are measured only once in three years or once in five years depending on the size of supply. PAH are never detected in drinking water (Klenner, Amt der Niederösterreichischen Landesregierung, Pers. Comm.).

A recent survey of groundwaters and surface waters, including the Danube, has revealed PAH at a few locations in the area of Vienna due to industrial pollution.

5.2 Belgium

5.2.1 Summary

Compliance with the PAH parameter does not appear to be of much concern among water suppliers and a Regional Association responsible for water quality in Belgium, although coal tar and bitumen lined pipes have been installed in the past. Pipes lined with

coal tar pitch apparently have not been installed since the 1940s (Legros, Belgaqua, Pers. Comm.). However, some coal tar lined pipes must still be in use, since incidents of PAH contamination, due to partial detachment of lining, were mentioned.

5.2.2 Use of coal tar lined pipes

Coal tar or bitumen lined pipes have been used in the past, but are no longer installed. Although the distinction has been established ('brès d'houille' or 'goudron de charbon' for coal tar pitches versus 'bitumen' or 'goudron de pétrol' for bitumen) the terms often seem to be confused by the professionals. The lining of pipes with coal tar pitch apparently ceased in the 1940s. This broadly agrees with the information provided by the pipe manufacturers Pont-à-Mousson, who maintain that the use of coal tar lined pipes was discontinued in continental Europe (replaced by cementitious lining) much earlier than in the UK (see Section 5.5.2 - France). The main problem with old coal tar/bitumen lined pipes was quoted as 'physical', i.e. partial detachment of lining, giving rise to biofilms and organoleptic problems.

We have not managed to get details of the approximate percentage of coal tar lined pipes still in the ground, although judging from occasional incidents of PAH contamination, some must be still in use.

5.2.3 Monitoring of PAH in drinking water

As the results of drinking water quality monitoring are not published, we have attempted to pursue this by contacting water companies directly, including the major suppliers (and including hard water supplies). Drinking water quality is monitored at various points, i.e. at the treatment works, in the distribution system, and about 20% of samples are taken from taps and include PAH analyses. PAH were said to be not normally found, but rare incidents of PAH contamination, due to partial detachment of lining were mentioned. No data were available.

5.3 Denmark

5.3.1 Summary

PAH does not appear to be considered a problem by those concerned with water supply and quality in Denmark (Hoeris, DVF, Pers. Comm.). The Danish Water Supply Association and several County Councils responsible for water supply and water quality were contacted, but no-one seemed to be aware of any potential problems, and no details of pipe materials, nor data of drinking water monitoring were available.

However, coal tar lined pipes seem to have been used in the past. Due to generally very hard groundwaters, these pipe linings were said to be coated with calcium carbonate, and thus not directly in contact with drinking water (although this situation seems likely to give rise to intermittent problems of PAH leaching, no such problems appeared to have

been encountered). PAH are monitored regularly in the distribution system, though at service reservoirs, not at consumers' taps (Hjelmar, VKI, Pers. Comm.).

PAH research is carried out at the Water Quality Institute (VKI) but focuses on waste sites and old gas works (potential source of coal tar for use as pipe lining material in the past?), soil contamination and potential groundwater contamination (particulate transport in groundwater). The main concern with respect to drinking water quality relates to nitrate and pesticide contamination of groundwaters which constitute the main source of drinking water in Denmark (Hjelmar, VKI, Pers. Comm).

5.4 Finland

5.4.1 Summary

PAH in drinking water is of little concern to water suppliers and authorities in Finland. Waters in Finland are generally very aggressive; coal tar lined pipes have never been used extensively, and where they were used, the lining has long since 'dissolved' and had to be replaced. There are many small supplies (wells for single houses or small communities) without sizeable distribution systems. Most of the large distribution networks are relatively new and plastics have been used since the 1970s. Isolated cases of PAH in drinking water supplies were due to contamination of shallow groundwaters (which receive little treatment) with wood preservatives (mainly different PAH to those specified in the Drinking Water Directive) (Hiisvirta, Ministry of Social Affairs and Health, Pers. Comm.).

5.5 France

5.5.1 Summary

Coal tar lined pipes have been installed in the past, but no information was available of the extent of their use. Their use was discontinued earlier (1960) than in the UK. PAH is not normally monitored at the consumers' taps (not required in the legislation), though some such monitoring appears to have been introduced recently as a result of a survey to assess the occurrence of PAH in drinking water in distribution systems. The results are not available; an official summary report of drinking water quality in France refers to one case of non-compliance with the PAH parameter (460 ng l^{-1} fluoranthene), but gives no details of the other results and it is unclear whether all samples were taken after distribution of the drinking water.

5.5.2 Use of coal tar lined pipes

Statistics on types of mains in use in French drinking water distribution systems indicate that 33% consist of cast iron pipes (47% PVC, 8.1% asbestos cement, 7.4% steel). A similar proportion of cast iron (ductile) is used in new installations (replacements and new

networks). The average age of pipes in France is relatively young at about 20-50 years (TSM 1993). We have not been able to obtain much information on lining, though it is likely that some coal tar lined pipes are still in use. Coal tar was used to line pipes in the past, its use for interior lining of pipes had ceased by 1960, though it continued to be used as external coating. The main reasons for abandoning its use as an internal lining were given as taste and odour problems in chlorinated waters and physical problems, i.e. detachment of lining. Bitumen is still used today, the material has officially been approved for use in contact with drinking water, though it is now mainly used for sealing joints (Rigale, CRECEP, Pers. Comm.). Cementitious linings seem to be used widely (Bustarret, AGHTM, Pers. Comm. and Rigale, CRECEP, Pers. Comm.). A major manufacturer confirmed that the use of coal tar was abandoned much earlier in continental Europe than in the UK, and was replaced mainly by cement before 1960 (Goguillot and Langenfeld, Pont-à-Mousson, Pers. Comm.). Moreover, unlike in the UK where cement is often sealed (e.g. with bitumen) this is not the general practice in Continental Europe.

One contact from a water supply company informed us that they have only concrete and steel pipes (large diameter), cast iron lined with cement (intermediate size) and plastic pipes (small diameter) (Mercier, Syndicat des Eaux d'Ile-de-France, Pers. Comm.).

5.5.3 Monitoring of PAH in drinking water

On the whole there does not seem to be much monitoring at consumers' taps, neither by the local/regional health authorities (DDASS) nor by the water companies. The drinking water legislation (Decree 89-3, amendment of 3 January 1989) does not require PAH to be monitored at consumers' taps.

However, it appears that there may be a problem in some areas. A recent survey was mentioned, but we were told on several occasions that the results were confidential and with the Ministry of Health. We were unable to establish whether a report existed (Ministry not contacted). One of our contacts at a water company was a member of an expert committee which was set up to investigate the problem of PAH; following the above survey, he recommended that PAH should be monitored regularly by the authorities in drinking water samples taken after distribution. Consequently a circular was issued to this effect, but it is not clear how much this advice has been followed.

We have obtained the first and only comprehensive drinking water quality report published to date by the Directorate General of Health (Direction Générale de la Santé, 1993) in response to the requirement to provide drinking water quality data to the Commission. The report covers data for 1989, 1990 and 1991. Analyses for supplies serving >10 000 inhabitants were considered. PAH were analysed in 471 of 878 (53.6%) such supplies. The total PAH parameter was exceeded in one of three samples in one supply, and was due to fluoranthene at 460 ng l^{-1}. This is likely to be due to coal tar lined pipe. The report does not make it clear whether PAH were measured in the distribution system, although it is indicated that additional parameters (not normally required to be measured in distribution, but likely to be affected by distribution) were analysed in the distribution system.

Workers at CRECEP, the laboratory responsible for monitoring drinking water quality in Paris, take samples for PAH analysis at consumers' taps once a month. Apparently there are never any problems of compliance, though the results are not available. The results are passed to the health authority, where a summary report on drinking water quality may be issued from time to time (Rigale, CRECEP, Pers. Comm.).

5.6 Germany

5.6.1 Summary

Judging from the extent of use of coal tar lined pipes in the past, isolated PAH surveys and ongoing research, there seem to be intermittent problems with PAH in drinking water in Germany, though this is not officially acknowledged. Coal tar lined pipes were used very extensively (30 to 60% of mains), but the amount is decreasing due to replacement/relining programmes. PAH seem to be detected in drinking water whenever a survey is conducted on samples taken from distribution systems. However, in most cases, the problems may remain undetected, since official analyses are carried out on samples taken at treatment works. Consequently PAH are not generally recognised as a significant problem, although the issue has been raised in the parliament of the State of Baden-Württemberg. Moreover, the Federal Authorities (Federal Ministry of Health - Bundesgesundheitsamt, BGA) have recommended that a short-term limit of 700 ng l^{-1} for 'carcinogenic' PAH can be justified in unavoidable cases; this again suggests that there are PAH problems at times.

5.6.2 Use of coal tar lined pipes

Germany has a high percentage of very old distribution systems with little available information on composition, though coal tar lining was used extensively and it has been estimated that 30 to 60% of mains consisted of coal tar lined pipes (Maier, Stadtwerke Karlsruhe, Pers. Comm.) depending on the network. The installation of coal tar lined pipes ceased in 1972 for reasons of concern about PAH (health concern), but some old stock may have been used after that, up to about 1975. These were mainly substituted by cement lined pipes, since Germany has a high proportion of hard groundwater for which cement is suitable.

The above applies to the former Western German States (Länder); coal tar was not used in the five States of the former Eastern Germany and a recent survey confirmed the absence of PAH in drinking water samples taken from the distribution system (Wricke, TZW Dresden, Pers. Comm.). The reason is that those parts of Germany are brown coal areas and, consequently, coal tar was not produced there, whereas coal tar (from gas production from anthracite) was widely available in the other parts of Germany.

Bitumen was used in all of Germany for pipe and reservoir lining, but probably not very extensively. Microbiological problems seem to be the reason for replacing such linings with more suitable materials (Obst, Wasserwerke Mainz, Pers. Comm.; Bernhardt and Liesen 1988).

In general, extensive replacement/relining programmes are underway in many areas (Anon 1996), gradually reducing the amount of coal tar lined pipes still in use; however, one contact from a major water company quoted about 10-20% coal tar lined pipes still present in its network. A paper on renovation of old pipes described a process of pulling steel or ductile iron pipes through old pipes where the diameter of the old pipe allowed this; in the case study described in this paper, cement mortar lined pipes were relined using this process (Kleinau and Krietenbrink 1995).

5.6.3 Monitoring of PAH in drinking water

Official analyses (for compliance purposes) are carried out by local and regional health authorities on samples taken at treatment works, even for PAH (only microbiological analyses are done on samples from the distribution system) (Brauch, TZW Karlsruhe, Pers. Comm.).

However, most large town suppliers carry out their own monitoring in the distribution system in order to pick up problems and deal with them by pipe renovation or replacement. These data are not in the public domain and cannot be obtained. Although consumers have a right to access information on the quality of their drinking water, the results presented will be annual averages and will not include problem samples from the distribution system, since there is no legal requirement to analyse these. For example, the water supply company in Bremen (Bremer Stadtwerke AG, 1995) supplies annual averages for all parameters for each of their four supply zones; total PAH is reported to be always below the limit of detection (0.05 $\mu g\ l^{-1}$) but the analyses appear to have been carried out on treated water samples taken at the works.

The Federal Annual Report on Water for the year 1995 was obtained (Anon 1996). This covers all aspects of water, i.e. water resources, flood protection, coastal protection, groundwater and surface water quality, waste water treatment, drinking water supply and financial aspects. The report contains a summary for Germany as a whole, and contributions from each State. None of the reports from individual States contain drinking water quality data; only one State (Sachsen-Anhalt) contributed a table on exceedance of drinking water parameters, in terms of number of inhabitants supplied with water exceeding the limits for (i) Fe/Mn, (ii) Ca/Mg/Cl/SO_4, (iii) NO_3 and (iv) heavy metals; exceedances were reported for all, except the heavy metals, but no other parameters were presented. No comprehensive drinking water quality report has been issued to date by the Federal authorities, although much data from individual States has been available to them for over three years (Brauch, TZW Karlsruhe, Pers. Comm.).

5.6.4 Problems with PAH in drinking water

Clearly, there are intermittent problems with PAH in drinking water, although the old coal tar lined pipes are gradually being replaced. One expert maintained that so much attention was paid to the problem in the sixties and seventies that most problem pipes have by now been replaced, except perhaps in smaller, rural networks (Kühn, TZW Karlsruhe, Pers. Comm.).

However, a recent survey carried out by the authorities in one of the German States (results confidential) indicated significant problems, though most sampling appears to have been done at hydrants, resulting in the release of particulate matter which was no doubt responsible for the high concentrations of PAH (Kühn, TZW, Karlsruhe, Pers. Comm.). Nevertheless, the survey certainly indicates that there are still coal tar lined pipes in use.

Some results of PAH monitoring by the authorities of the State Baden-Württemberg have been published (CLUA 1995). Of 56 drinking water samples taken at the end of the distribution system (probably consumers' taps), PAH were detected in 29 samples (Table 5.1); fluoranthene was the most frequently detected and present at much higher concentrations (max. 190 ng l^{-1} expressed as carbon, i.e. about 210 ng l^{-1} fluoranthene) than the other five regulated PAH; the maximum concentration of total PAH was 191 ng l^{-1} expressed as carbon (Trinkwasserverordnung 1990), i.e. about 210 ng l^{-1} PAH. The German limit for PAH is set at 200 ng l^{-1} expressed as carbon, i.e. about 10% higher than the EU standard. Another table (Table 5.2) gives actual concentrations for 13 of the 16 US-EPA prescribed PAH in the 11 out of 45 samples (groundwater and drinking water samples from a distribution system) where total PAH were >50 ng l^{-1}. In these, fluoranthene concentrations (max. 190 ng l^{-1} as C) were always much higher than the other EU regulated PAH (ranging from <1 to 4 ng l^{-1}), though in six samples these were exceeded by phenanthrene concentrations (ranging from 67 to 610 ng l^{-1} as C). The report refers to results in previous years where the PAH standard was frequently exceeded, but the data were not available. The report concludes by saying that the problem had been alleviated by the installation of activated carbon treatment, which resulted in PAH concentrations falling below the drinking water limit, despite the fact that the distribution system comprised coal tar lined pipes with high PAH leaching rates. This statement seemed somewhat strange, but it has been confirmed independently, that there was a case where activated carbon treatment was installed at a point (pumping station, service reservoir or similar installation) within the distribution system, and that this resulted in successful reduction of PAH concentrations (Brauch, TZW Karlsruhe, Pers. Comm.).

Table 5.1 Results of a survey of PAH in drinking water in Germany (from CLUA 1995)

PAH	Number of samples						
			PAH expressed as ng l^{-1} C				Max
	analysed	PAH detected	<50	50-100	101-200	>200	conc. ng l^{-1} C
Fluoranthene	35	29	25	2	2	-	190
Benzo(b)fluoranthene	35	8	8	-	-	-	3
Benzo(k)fluoranthene	35	4	4	-	-	-	2
Benzo(a)pyrene	35	3	3	-	-	-	4
Benzo(ghi)perylene	35	1	1	-	-	-	2
Indeno(1,2,3-cd)pyrene	35	2	2	-	-	-	3
Total PAH	56	29	25	2	2	-	191

Table 5.2 Results of an extended survey of PAH in drinking water in Germany (from CLUA 1995) (expressed as µg l^{-1} Carbon)

Fluorene	Phe	Ant	Flu*	Pyrene	BaA	Chrysene	BbF*	BkF*	BaP*	DbA	BghiP*	IP*	Total PAH	Total PAH*
0.043	0.1	0.001	0.041	0.01	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.2	0.041
0.011	0.11	0.001	0.038	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.163	0.038
0.009	0.15	0.001	0.07	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.234	0.07
0.013	0.076	0.001	0.045	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.139	0.045
0.061	0.61	0.003	0.17	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.85	0.17
0.076	0.57	0.003	0.19	0.009	<0.001	0.013	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.952	0.191
0.009	<0.024	0.001	0.015	<0.003	0.002	0.003	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.055	0.016
0.013	0.048	0.008	0.084	0.03	0.006	0.005	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.19	0.085
0.013	<0.005	0.001	0.031	0.003	<0.001	0.004	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.103	0.032
0.002	0.007	0.001	0.017	0.011	0.004	0.004	0.003	0.002	0.004	<0.001	0.002	0.003	0.06	0.031
0.016	<0.005	0.001	0.039	0.006	<0.001	0.006	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.120	0.041

Phe = Phenanthrene, Ant = Anthracene, Flu = Fluoranthene, BaA - Benzanthracene, BbF = Benzo(b)fluoranthene, BkF = Benzo(k)fluoranthene, BaP = Benzo(a)pyrene, DbA = Dibenz(a,h)anthracene, BghiP = Benzo(ghi)perylene, IP = Indeno(1,2,3-cd)pyrene.

* PAH specified in German Drinking Water Regulations (Trinkwasserverordnung 1990)

Limited data were obtained for samples taken from distribution systems in Baden-Württemberg (Maier, Stadtwerke Karlsruhe, Pers. Comm.): 3 out of 251, and 4 out of 163 samples exceeded 200 ng l^{-1} for total (6) PAH in 1994 and in 1995, respectively.

One researcher at an institute of a water supplier is carrying out a research project on PAH in drinking water, though focusing mainly on the effect of residual oxidant on PAH leaching and reactions with PAH (Maier, Stadtwerke Karlsruhe, Pers. Comm.). A report or paper should become available in the near future. Whilst results have not been made available, the fact that this work is being carried out, again suggests that there are still coal tar lined pipes in use and, consequently, problems with PAH in distributed water are likely.

In the State of Hessen, there also seem to be intermittent problems with PAH. A survey (about 300 samples at many different points in distribution systems) was carried out recently by a major water supplier in conjunction with the health authorities (not published, data not available). The conclusion was that there were no problems during normal usage of water, only if water remained in a pipe for a prolonged period of time, or if there were sudden surges; the PAH were associated with particulate matter, and assumed not to be reaching the consumers' taps, as consumers' supplies were normally fitted with a fine filter which was said to hold back any particulate matter (see Section 4.6.5) (Pilz, ESWE Wiesbaden, Pers. Comm.).

At a major water supplier in the State of Rheinland-Pfalz, where about 10-20% coal tar lined pipes are still in use, PAH are measured from time to time in samples from the distribution system where coal tar is known to be present. Severe problems (high levels of PAH - results not available) were experienced recently in one part of the network; this led to the replacement of the coal tar lining with cement mortar lining (Obst, Wasserwerke Mainz, Pers. Comm.).

A survey of drinking water throughout distribution systems was also carried out recently in the former Eastern German States. The results were not available, but these, together with a survey of pipe materials used in the past, confirmed the absence of PAH and coal tar lined pipes (Wricke, TZW Dresden, Pers. Comm.).

5.6.5 Retention of particulate matter and PAH in filters

The installation of mechanical filters at the point of entry of the water supply to a property is now a legal requirement in Germany, probably in connection with protecting water meters which are generally used, but many old properties will not have them. However, such filters in the UK normally have mesh sizes of around 0.8 - 1 mm, although finer meshes may be in use in Germany. Whilst not specifying mesh sizes, the German standard (DIN 19 632, DIN 1987) for such filters uses 80 µm pore size in its example for testing particle retention. The filters may be made of woven fabric or cloth, synthetic felt, metal, ceramic etc. In the absence of any experimental data, it is difficult to see what the effect of these filters will be on PAH, although it is well known that losses occur readily through adsorption on surfaces during PAH analyses. In addition, home filtration units installed at the point of entry of the water to the property, are very popular in Germany. This has

been mentioned as causing difficulties with respect to any representative sampling from consumers' taps, since water quality parameters may change due to these filters which are entirely the responsibility of home owners.

5.6.6 PAH Analysis

The German standard method (E-DIN 38 407 F 8, Reupert and Brausen, 1994)) is similar to the 'Blue Book' Method B (The Environment Agency 1997), using solvent extraction followed by HPLC with fluorescence detection and should recover particulate and dissolved PAH. However, it includes an extract drying and filtration stage which could lead to losses. Performance data of a slightly modified method (but including this drying and filtration stage) given by Reupert and Brausen (1994) shows average recovery rates ranging from 88-96.8% for 15 different PAH and standard deviations ranging from 4.1-9.2. As with the 'Blue Book' method, the technique could be prone to 'swap-over' in retention times between fluoranthene and pyrene, depending on chromatographic conditions and temperature. If this occurred unnoticed, it could lead to underestimates of fluoranthene, as pyrene levels are usually much lower.

As in the UK, the use of a standard method is not compulsory, and performance data can of course vary from laboratory to laboratory. We have no details of the methods used to obtain the data we received and cannot comment on their reliability.

5.6.7 Questions in the Parliament of Baden-Württemberg

Some interesting questions concerning PAH in drinking water were raised in the parliament of Baden-Württemberg in April 1994 (Landtag von Baden-Württemberg 1994):

- To what extent is the occurrence of PAH in drinking water known?
- Is the use of coal tar lined pipes responsible for the PAH?
- To what extent are such pipes still in use?
- Is it true that analyses are carried out mainly on samples from treatment works or drinking water storage tanks, instead of the consumers' taps which results in disguising the real situation concerning PAH in drinking water? - If yes, what is the government proposing to do about it?
- Which PAH limits are important and what are the health risks?
- What are the measures to protect the consumers and what remedial actions are being undertaken?
- What financial assistance is the government providing for such remedial action?

Answers were provided along the following lines in July 1994 (Landtag von Baden-Württemberg 1994):

- PAH were detected in a distribution network in Neckau-Odenwald, although analyses were negative at the reservoir prior to distribution. It is suspected that the PAH may be derived from coal tar lined pipes.

- Relatively high levels of PAH have been detected occasionally in drinking water, significant contraventions of the standard are rare, however.

- In most cases the observed PAH contaminations of drinking water has almost certainly been due to coal tar lined pipes, but such lining has not been used since the early 1970s and does not necessarily lead to PAH contamination.

- The extentof such pipes still in use will be investigated, but this is likely to take some time.

- It would be advisable to take samples for PAH analyses at various points in the distribution system.

- As part of compliance monitoring of drinking water, 300 additional samples from distribution systems will be analysed for PAH in the course of this year (1994).

- Exceedance of the limit of 0.2 $\mu g\,l^{-1}$ for total PAH does not constitute a health hazard, although some PAH are considered carcinogenic. The Federal Department of Health (Bundesgesundheitsamt - BGA) has recommended a limit of 0.4 $\mu g\,l^{-1}$ concentrations for carcinogenic PAH[1] for temporary, unavoidable exceedances and based on a more recent evaluation, a limit of 0.7 $\mu g\,l^{-1}$ is justified on a temporary basis[2].

- As an interim measure, consumers can flush the pipes to avoid high levels of PAH (since these are usually higher after prolonged residence time of water in pipes). On completion of further investigations, the government will decide to what extent renovation of distribution systems is required.

- There is at present no legal requirement to provide government funding for network renovations, but the current guidelines are under review. Whether government funding can be provided, and how much can be covered by water charges, will need to be established in the near future.

On another occasion (November 1995) questions were asked concerning benzo(a)pyrene in drinking water (Landtag von Baden-Württemberg 1995). It appears that 210 $ng\,l^{-1}$ benzo(a)pyrene was found in a sample from a distribution system. No comment as to the cause was offered, but the need for further investigation was pointed out.

[1] Presumably benzo(a)pyrene - Author's comment

[2] Must be based on WHO 1993 revised guideline value for benzo(a)pyrene - Author's comment

5.6.8 Concluding comments

In Germany where a high proportion of drinking water is derived from groundwater and receives little or no treatment, the prevailing attitude is that any anthropogenic pollutants such as PAH should not be present in drinking water. Moreover, the politicians are very reluctant to relax standards for fear of being accused of allowing a deterioration in drinking water quality. In the recent annual report on water from the Federal Ministry of the Environment it is stressed that the current, stringent drinking water standards must be maintained (Anon 1996).

Some scientists, however, expressed the view that it would be better to have only one PAH regulated, e.g. benzo(a)pyrene based on a toxicological evaluation, or one surrogate to cover all PAH, possibly fluoranthene (Kühn, TZW Karlsruhe, Pers. Comm.). The German Association of Gas and Water Suppliers (BGW - Bundesverband der Deutschen Gas- und Wasserwirtschaft) commented on the revised Directive, concerning benzo(a)pyrene (10 ng l^{-1}), that the introduction of this parameter could lead to expensive restoration in the network (BGW 1994), although the real problem clearly lies with fluoranthene (if analysed correctly) as in the UK. Abke (1994) also referred to possible problems with compliance with the benzo(a)pyrene and specifically mentioned problems due to old coal tar lined pipes in the distribution system. However, at least the State of Baden-Württemberg has already adopted the limit of 10 ng l^{-1} for benzo(a)pyrene in its drinking water regulation (each State in Germany has its own Drinking Water Regulations, which may be more stringent than the Federal regulations).

The Federal committee of experts on drinking water (Trinkwasser Kommission) does not regard PAH as an important issue at present (Frimmel, member of Trinkwasser Kommission, Pers. Comm.).

Despite the fact that Germany has a very high proportion of coal tar lined pipes still in use, PAH in drinking water and compliance with the revised Drinking Water Directive seems to be regarded as a minor problem, even if samples will have to be analysed at the point of supply to consumers.

5.7 Greece

5.7.1 Summary

All attempts to contact water suppliers, research institutes and university departments failed. A reply was received only from a consultancy firm. Our contact revealed that coal tar and bitumen lined pipes were used in the past to a limited extent and under specifications, but are no longer installed today (mainly plastic materials are now used) (Economidis, LDK Consultants, Pers. Comm.). We have not been able to get any indication of possible problems with PAH, nor any information on monitoring, except the reassurance that the Greek drinking water regulations (Ministerial Decree A5 288 of 23 January 1986) follow the requirements of the EU Drinking Water Directive.

5.8 Ireland

5.8.1 Summary

The true extent of PAH problems in Ireland has not been established since the mains records are insufficient and PAH are not routinely monitored. However, PAH are not perceived to be a problem by the water undertakers in Ireland.

5.8.2 Use of coal tar lined pipes

Records are not sufficiently detailed to show historic mains materials. Cement lined ductile iron has been used for the past 20 years and, more recently, PVC. Prior to that, mains will have been cast iron but it is not known if these were coal tar pitch coated. Most of the contacts made to those responsible for water supply had not heard of PAH or coal tar pitch coatings, whilst a couple of contacts thought that there would be very few, if any, coal tar lined mains.

5.8.3 Monitoring of PAH in drinking water

PAH are not monitored routinely in drinking water in Ireland; the national report on drinking water quality does not include any data on PAH (Flanagan 1994). Raw waters are checked occasionally for pollution. No method of analysis appears to have been established at any laboratory until about three years ago. A survey of PAH in drinking water (presumably at consumers' taps to establish whether the mains presented any problems?) was mentioned (O'Reilly, Dublin Corporation, Pers. Comm.); total PAH results were thought to have been all below the EU standard, but it has not been possible to obtain any data.

5.9 Italy

5.9.1 Summary

The available data on pipe lining materials and drinking water surveys suggest that there is no difficulty in meeting the PAH standard. However, PAH do not appear to be monitored very often in drinking water distribution systems in Italy. The situation was reviewed by the Institute of Health (Istitute Superiore di Sanità) in the context of a review of the toxicity of PAH; no evidence of coal tar lined pipes or significant levels of PAH were found. However, our contact at the Institute does not consider the available information adequate (Funari, Istituto Superiore di Sanità, Pers. comm.).

5.9.2 Use of coal tar lined pipes

Menichini and Rossi (1991) have provided a summary of the pipe materials and linings in use in 10 cities in Italy. This shows a very high proportion of cast iron pipes, followed by steel (highest proportion in one city) and in some cases asbestos cement (highest proportion in two cities). The highest proportion of internal lining is bituminous, followed by cement, and the average age of the pipes ranges from 20-40 years in the different cities. The table makes no reference to coal tar, although the authors of the report clearly distinguish between coal tar ('catrame') by reference to its use in the UK and bitumen ('bitume'). Judging from this data and the surveys (see below) it is possible that coal tar lined pipes were not used extensively in Italy, or abandoned a very long time ago and not many such pipes left (in line with information on continental practice, as suggested by the French pipe manufacturer, see Section 5.5.2, who is also represented in Italy).

5.9.3 Monitoring of PAH in drinking water

PAH in drinking water do not appear to be monitored frequently, since occasional sampling has shown very low concentrations (below EC MAC). Data summarising surveys carried out between 1987 and 1990 in six cities in Italy show total (six prescribed) PAH concentrations ranging from below detection limit to 23 ng l^{-1} for individual PAH (or maximum concentration of 7 ng l^{-1} for regulated PAH fluoranthene; up to 21 PAH were analysed) (Menichini 1992, Menichini and Rossi 1991). Benzo(a)pyrene was detected once at 0.6 ng l^{-1}. Samples were taken from the distribution system or consumers' taps. Pipes in the distribution system of one of the supplies were lined with bitumen, another supply consisted of galvanised iron pipes; no detail was given for the other three supplies. Low levels of PAH were detected (up to 1.7 ng l^{-1} fluoranthene) in the bitumen lined system when samples were collected at 06.00 hours, none were detected when samples were taken at 10.00 hours at a different point two days later.

5.10 Luxembourg

5.10.1 Summary

PAH in drinking water do not appear to be of concern to water suppliers in Luxembourg. Practically 100% of pipes seem to be cement lined (90% steel, 10% ductile iron). Neither coal tar nor bitumen lining are in use today, nor have they been in the past and there appear to be no problems in meeting the PAH standard (ALUSEAU, Pers. Comm.).

5.11 The Netherlands

5.11.1 Summary

PAH in drinking water do not appear to be considered a problem by water suppliers and authorities in the Netherlands. It appears that coal tar lined pipes were only used by one

water supplier in The Netherlands in the past and these have now been replaced or relined. The use of coal tar and bitumen products in contact with drinking water has been banned since the early eighties. PAH are only monitored in raw and treated waters as a pollution check, they are not monitored after distribution of the drinking water.

5.11.2 Use of coal tar lined pipes

Coal tar pitch lined pipes do not appear to have been used widely in The Netherlands. In fact only one water distributor is thought to have used this material and these mains have now all been replaced or relined (van Dijk, KIWA, Pers. Comm.). The use of coal tar and bitumen products in contact with drinking water has been legally banned since the early 1980s. However, bitumen lining is still used on the external surfaces of water mains and coal tar exterior coating may still exist. Bitumen is also used to coat raw water storage tanks. It is possible that old coal tar lined raw water reservoirs are still in use.

5.11.3 Monitoring of PAH in drinking water

PAH are not monitored in distribution systems, nor at the consumers' taps. Raw and treated waters are monitored for PAH but only as a pollution check. Any PAH found have been at levels well below the EU standard and are usually removed during water treatment.

The potential problem of PAH leaching was investigated about 15 years ago. It seems that through this survey the old, existing system with coal tar lined pipes (one supplier only) was identified and remedial action taken as a result (replacement or relining of pipes). We have not been able to obtain details of this survey. Now it is considered unnecessary to monitor PAH in the distribution system. Some PAH results for 1994 were received (Versteegh *et al.* 1994, Anon 1995), but all samples were taken at treatment works and pumping stations. The six regulated PAH were analysed with the limit of detection varying between 1 and 20 ng l^{-1}; PAH were detected in 22 of 545 samples from raw water intakes (27 sites) and in 16 of 289 treated water samples (30 sites); actual concentrations were not presented. In another survey, low levels of PAH were found in treated water; i.e. fluoranthene 3.7 ng l^{-1} in two waters, total PAH 7.8 ng l^{-1} respectively. In a pre-treated water, similarly low levels of PAH were found; these were thought to have been derived from bitumen lined raw water storage tanks.

5.12 Portugal

5.12.1 Summary

PAH in drinking water do not appear to be considered a problem by water quality professionals and researchers in Portugal. Coal tar lined pipes are not thought to have been used extensively in the past. However, we have not succeeded in obtaining details of the use of coal tar lined pipes, nor any information on monitoring practice, nor any data.

5.13 Spain

5.13.1 Summary

Coal tar lined pipes have been used, probably relatively small amounts, but their installation ceased about 1960 or earlier. PAH are monitored in drinking water at consumers' taps, but no data can be obtained. Isolated cases of high levels of fluoranthene were mentioned, suggesting that some problems exist. However, in view of likely inadequacies in monitoring, these may not be observed very often.

5.13.2 Use of coal tar lined pipes

Coal tar lined pipes have not been used at least since 1960 or earlier, though some coal tar lining has been used in the past (Bergareche, information obtained from Funditubo, Pers. Comm.). Much of this has been replaced or relined due to scale build-up. However, it seems likely that a certain amount of coal tar lined pipe is still in use, though such pipes are considered too old to have any lining left. The early abandonment of coal tar lining agrees with the information made by the French pipe manufacturer (see Section 5.5.2, the same company under a different name supplies Spain).

The most commonly used pipe material up to the seventies and eighties was asbestos/cement (Mialet 1996), and ductile iron with cement mortar lining has been used extensively in the past 30 years or more. Major pipe replacement programmes and building of new networks are underway; cement lined pipes are used to a large extent today, or epoxy resin lining (Bergareche, Mejoras Energeticas, Pers. Comm.).

5.13.3 Monitoring of PAH in Drinking Water

PAH are routinely analysed in drinking water; samples are taken from taps in public buildings (100 sampling points were quoted for one city) (Sevilla, Istituto Municipal de Salud Pública, Zaragoza, Pers. Comm.). It was not possible to obtain any results; results were said to be confidential; the laboratories pass them to the local authority (e.g. Mayor of a city). A note is published occasionally in the local paper, giving general comments on drinking water quality. Consumers should also be able to obtain information on their drinking water quality from the Mayor through a written request.

However, one drinking water analyst thought that PAH were not generally analysed frequently; he also referred to the absence of an official method of analysis, and considerable problems with the analyses.

One contact referred to isolated findings of high levels of fluoranthene; this could suggest that there are more coal tar lined pipes than generally admitted, especially in view of the likely inadequacies of monitoring PAH.

5.14 Sweden

5.14.1 Summary

PAH do not appear to be of concern to water suppliers and public authorities in Sweden. Coal tar pitch lined pipes have never been used and regular monitoring in the past from consumers' taps has not revealed any problem.

5.14.2 Use of coal tar lined pipes

Pipes lined with coal tar pitch have never been used in Sweden, though there are some bitumen lined mains (Hendenberg, VAV, Pers. Comm.).

5.14.3 Monitoring of PAH in drinking water

Until two or three years ago PAH concentrations were monitored regularly in raw and treated water, including samples from consumers' taps. This practice was abandoned because PAH concentrations were always well below the EC MAC and usually below the analytical detection limit. Now a few samples (raw, treated and consumers' taps) are still analysed occasionally as a pollution check; for example we were told of a survey currently being undertaken at 6-7 supplies in Gothenburg, where samples are being taken from raw and treated water, including from consumers' taps, though this survey does not appear to be complete and we have not been able to obtain any results.

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APPENDIX A

GLOSSARY OF TERMS FOR COAL TAR PITCH, BITUMEN AND PAH IN MAJOR LANGUAGES OF THE EU

GLOSSARY OF TERMS FOR COAL TAR PITCH, BITUMEN AND PAH IN MAJOR LANGUAGES OF THE EU

Language	Coal tar pitch	Bitumen	PAH
French	Goudron de charbon Brès d'houille	Goudron de pétrol Bitume	HAP HPA
German	Teer (teergetauchte Rohre - coal tar lined pipes)	Bitumen, Asphalt	PAK
Italian	Catrame	Bitume (rivestimento bituminoso - bitumen lining)	IPA
Spanish	Alquitrán Braes de alquitrán	Asfalto Betunes asfálticos	IPA

APPENDIX B

LIST OF ORGANISATIONS CONTACTED IN EU MEMBER STATES

LIST OF ORGANISATIONS CONTACTED IN EU MEMBER STATES

Country	Contact	Function/Responsibility
Austria	Amt der Niederösterreichischen Landesregierung, Vienna	Authority responsible for drinking water quality in the largest state (Land Niederösterreich) of Austria, including Vienna
	ÖVGW (Österreichischer Verband für das Gas- und Wasserfach)	Austrian Association for Professionals in the Gas and Water Industries
Belgium	Belgaqua (formerly NAVEWA/ANSEAU)	Belgian Waterworks Association
	AQUAWAL (Regional Association)	Water quality
	Major Water Companies	Water supply
Denmark	Dansk Vandteknisk Forening (DVF)	Danish Water Supply Association
	Vandkvalitetsinstituttet (VKI)	Water Quality Research Institute
	County Councils	Water supply and distribution
Finland	Ministry of Social Affairs and Health, Helsinki	Responsible for drinking water legislation and quality in Finland
France	CRECEP	Research and official drinking water analyses for the Paris
	AGHTM	Association of Municipal Water Supply Professionals
	Major water supply companies	Water supply
	Pipe manufacturer	Provision of water distribution pipes
Germany	TZW (Technology Centre for Water - DVGW), Karlsruhe and Dresden	Applied research and routine analyses for water industry
	Research institutes (university and water suppliers)	Research
	Major water suppliers in four different Länder (States)	Water supply
	Member of the Trinkwasserkommission	Expert Committee on Drinking Water (Federal level)

Country	Contact	Function/Responsibility
Greece	LDK Consultants	Consultancy - Water Treatment and Supply
	HUMEWSS (Association of Municipal Enterprises for Water Supply and Sewerage	Water Supply
Ireland	Central laboratories	Analysis of water samples
	Environmental Protection Agency	Annual drinking water quality reports.
	County Councils	Water supply and distribution
Italy	Istituto Superiore della Sanità	Research Institute (Ministry of Health)
	Federgasaqua	Gas and Water Industry Association
Luxembourg	ALUSEAU	Water Supply Association of Luxembourg
The Netherlands	KIWA	Research and consultancy institute of water suppliers
	Water Suppliers	Water supply and distribution
Portugal	LNEC (Laboratorio Nacional de Engenharia Civil)	Research institute concerned with water quality, supply and distribution
Spain	Mejoras Energeticas	Consultancy
	Istituto Municipal de Saludad Pública (Zaragoza)	Compliance Monitoring
	Laboratorios Contox	Drinking water analyses (private laboratory)
	AEAS (Asociación Española de Agua y Saneamnto)	Spanish Association for Water Supply and Sewerage
	Funditubo	Major supplier of drinking water distribution pipes
	Large water supply companies	Water supply

Country	Contact	Function/Responsibility
Sweden	VAV	Water and Sewage Association
	Environmental Protection Agency	Municipal water department and food administration departments who provide guidelines on drinking water quality.
	County Councils	Water supply and distribution