Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Report on a contaminated drinking water incident in Counties Cavan and Monaghan

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Report on a contaminated drinking water incident in Counties Cavan and Monaghan

Summary:

This report describes an incident of contamination of drinking water in 5 Group Water Schemes (GWSs) in County Cavan and County Monaghan. On 19th April 2007, following a phone call from Monaghan County Council Environmental Health department, the HSE first became aware that the following 5 GWSs were likely to have been contaminated by a batch of tainted Aluminium Chloride (AC) - a coagulant used by Veolia Water (VW) in drinking-water treatment:

- Glaslough/Tyholland GWS Co Monaghan
- Bunnoe GWS Co Cavan
- Crosserlough GWS Co Cavan
- Dernakesh GWS Co. Cavan
- Kill GWS Co Cavan.

Following advice from the HSE, a warning not to use the water for drinking or food preparation was issued by Cavan and Monaghan County Councils on the 19th April. Alternative supplies of drinking water were arranged until the supplies were demonstrated to be clear of contamination.
The HSE were informed that use of suspect AC to treat water in these schemes had ceased and was replaced with approved product by 30th April.

The following 4 Group Water Schemes, which had also received suspect AC, had their supplies replaced with approved product.

- Billis/Lavey GWS Co Cavan
- Mountainlodge GWS Co Cavan
- Drumkeery GWS Co Cavan
- Dhuish

A possible hazard to consumers from use of suspect AC in these schemes was considered by the HSE . There was no direct evidence of contamination of drinking water and no complaints were received from consumers within these schemes. As all the original AC supplied to these schemes had been replaced by 20/04/07 a warning was not issued to consumers. However these GWSs may previously have been at risk.

On Thursday 17th May 2007, clearance was given by the HSE to recommence the operation of the group schemes with the exception of Glaslough/Tyholland. This followed three end-of-line samples on each scheme taken at intervals of at least twenty four hours being found to be free of all contamination. The scheme at Glaslough/Tyholland in Monaghan, which had been provided with an alternative mains water supply by Monaghan County Council, was considered satisfactory and cleared for use on 23rd July 2007.

Notification of this incident to HSE:

On Thursday 19th April 2007 the HSE Cavan/Monaghan Senior Environmental Health Officer received a call from an EHO working with Monaghan County Council notifying him that there had been complaints from consumers about a "bad taste and odour" from drinking water in Glaslough/Tyholland group scheme. The taste and odour were described as "like creosote". The problem was thought to have started about 3 to 4 weeks previously.
Preliminary investigations suggested that the problem was due to a phenol-like substance and that the source of the contamination may have been a batch of AC used in the treatment of water. The AC had been used by a water treatment company called "Veolia Water" on the Glaslough/Tyholland scheme. It was thought that they also supplied this product to at least four other Group Schemes in County Cavan. The HSE was in contact with Cavan County Council who confirmed that the following four GWSs were suspected to have chemical contamination:

- Bunnoe GWS Co Cavan
- Crosserlough GWS Co Cavan
- Dernakesh GWS Co. Cavan
- Kill GWS Co Cavan.

Samples had been taken and the County Council were awaiting results from the laboratory.

Immediate actions taken:

The HSE assembled an incident team to consider this episode. This team agreed that there was evidence of drinking water contamination in 5 GWSs in counties Cavan and Monaghan from an unknown chemical or chemicals. The team advised that:

- Both Cavan and Monaghan Local Authorities should take immediate action to prevent consumption of water from contaminated supplies (Appendix 1). A warning not to use the water for drinking or preparation of food was issued on the 19th April.
- The suspect AC must not be used to treat drinking water in any schemes. This product was removed from all schemes on 20th April 2007.
- Local Authority, HSE and GWS organisers should coordinate efforts to identify the contaminant or contaminants in the drinking water and in the AC used as soon as possible.
- Similar coordination should be used to try and determine the likely levels of exposure to contaminants in each of the affected GWS areas.

Further actions taken:

- The Environmental Protection Agency was alerted about this incident.
- Veolia Water was asked to investigate and determine if suspect AC had been supplied to any other water schemes.
- Other national agencies including Food Safety Authority of Ireland and Department of Agriculture were advised about the incident.
- Where water had been used for preparation of products e.g. Food, Ice etc., these premises were contacted and the products were withdrawn or discarded.
- Food samples were taken from food premises and sent for chemical analysis
- Records were checked to see if any unusual symptoms or illness outbreaks were reported by either hospital or Primary Care clinicians in any of the affected areas
- GWS areas were checked for the presence of vulnerable groups i.e. Nursing Homes, Childcare facilities, dialysis patients or health clinics. None of these groups were found within the at-risk areas.
- A representative from the Incident team attended joint meetings with the Local Authorities and GWS representatives. The first of these took place on 20th April. It was confirmed that the alleged contamination was confined to 5 Group Water schemes in Counties Cavan and Monaghan
- The United Kingdom Health Protection Agency (HPA) toxicology advice service in Wales was contacted. General advice about the measures needed to safeguard Public Health (based on the limited information available) was sought as well as specific advice about Phenols in drinking water. The advice given by the HPA was that water should not be used for drinking or food preparation until proven to be free of contamination.
- Veolia Water were contacted and agreed to forward details of chemical analysis results obtained when checking the suspect AC. The preliminary results were forwarded to the HSE and are in Appendix 1
- The producers of the coagulant used (Enva) were asked for information about the possible source or sources of contamination of the AC used. Their reply stated that Enva had supplied an Aluminium Chloride product to Central Chemicals who supplied Veolia. This product (CL1000) was not recommended for use in treatment of drinking water and was suitable only for wastewater treatment.

Criteria for Clearance of drinking water:

It was agreed that only when 3 successive samples of drinking water were proven to be clear of contaminants would the water be cleared for normal use. The samples must be:

- Taken at least 24 hours apart
- Taken from suitable sampling points and

- Tested by an accredited laboratory to confirm the absence of any products arising directly or indirectly from the possible contaminants

Sampling:

Initial Samples:
AC: The contaminated AC used was sampled and tested by Veolia (see Local Authority reports for details).

Water Samples: Results of drinking water sent for analysis were inconclusive. One set of samples confirmed the presence of Phenols and Polycyclic Aromatic Hydrocarbons (PAHs) in drinking water. The HPA expert advice was that water containing phenols would be unpalatable before it became harmful. Toxicological summary for Phenols and PAHs are in Appendix **

Food Samples: Chemical contamination was not detected in any of the food samples.

Follow-up Public Health measures after water clearance:

The HSE tried to determine the likely risk to consumers from this incident by:

1. Calculating exposure levels
2. Surveillance of symptoms/health effects

Exposure levels: In coordination with Veolia, Group Water Schemes and Local Authorities, efforts were made to determine the likely concentrations of contaminants in drinking water based on the amounts of suspect AC used in each GWS, the levels of chemical contaminants and average volume of water used.
Correspondence received 13th July from ENVA stated that the product CL 1000 supplied to Central Chemicals and subsequently supplied to Veolia is Aluminium Chloride based product used in *wastewater* and does not meet the United Kingdom standard for drinking water treatment. This product can have low levels of organics including phenol and parahydroxyacetophene present as residual impurities from the production process.

It was not possible to determine the exposure to contaminants with any exactitude. The fact that water is unpalatable at very low levels of phenol makes consumption of water in harmful quantities extremely unlikely.

Surveillance of symptoms:

- No symptoms or illnesses relating to drinking water were reported directly to the HSE during or since this incident.
- Although there were media reports of mouth irritation and nausea, patients with such symptoms did not present to HSE staff.

- The HSE received no reports of skin irritation or rashes arising from use of contaminated water.
- No unusual patterns of illness or symptoms were reported by General Practitioners in any of the affected GWS areas.
- There were no reports from veterinarians of animal ill health relating to drinking water during this period

Conclusions:

1. Chemical contamination of five Group Water Schemes in Counties Cavan and Monaghan became evident in April 2007. The contaminants included Phenols, Acetic Acid, Polycyclic Aromatic Hydrocarbons and other compounds.
2. The Aluminium Chloride product used in water treatment was the vehicle of contamination. This product had not been validated as suitable for use in treatment of drinking water.
3. A further four Group Water Schemes in County Cavan had received an Aluminium Chloride product which had not been validated as suitable for use in treatment of drinking water.
4. There was a delay in informing the relevant agencies. The initial response to complaints about drinking water focused on identification of contaminants with not enough emphasis on protection of consumers.
5. The HSE, once notified on 19th April, took immediate action to safeguard the health of consumers.
6. Liaison between the Local Authorities, HSE , The Federation of Group Water Schemes and individual Group Water Schemes worked well at all stages of this incident. However, there is a need for a single national agency to actively manage incidents where more than one Local Authority is involved.
7. It was fortunate that exposure to health risks from contaminated drinking water was minimised by low odour and taste threshold of the phenol compounds in the drinking water. Expert advice affirmed that drinking water would have been too unpalatable to become harmful.

Recommendations:

1. Clearer quality control criteria, for chemicals used in water treatment plants, are needed.
2. When a chemical incident in drinking water is suspected, particular attention should be given to expediting the provision of accurate information to all relevant agencies.
3. Enforcement agencies need to be empowered to sample, seize, remove and detain suspect chemical products used in the drinking water treatment process. Traceability of such chemicals should also be made easily apparent to such agencies.
4. A national agency, e.g. the Environmental Protection Agency, should be empowered to actively oversee the management of chemical incidents especially where more than one Local Authority is involved. This agency should also liaise with other national counterparts when more than one country is involved.
5. Legislative controls need to be amended to facilitate the above powers.
6. Out-of-hours availability of Public Health Doctors and Environmental Health Officers is required to maximise the speed of response to similar incidents in the future.
7. Drinking-water providers and relevant agents should prioritise protection of consumers when investigating complaints.
8. Combined training of Local Authority, EPA and HSE staff in dealing with drinking water incidents would help to optimise the combined response to such incidents.

Preparers of this Report:

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Appendix 1 Veolia Report for HSE 26/04/2007

On Thursday 19th April 2007 a "Do Not Drink" notice was issued to the Group Water Schemes (GWS) supplied from Dernakesh, Bunnoe, Kill, Glaslough and Crosserlough.

This was based on the fact there were numerous complaints of "bad"/TCP tasting drinking water, the cause of which was unknown at that time.

There were limited samples of water taken from the customers premises at the time of the unsatisfactory water, however the details of the location and the results obtained from these locations is not fully known by Veolia Water. The Group Water Schemes and County Council do have this information which we are in the process of obtaining to aid our understanding of the source of the taste and odours.

There have been samples taken from the coagulant suspected of being the root cause however only one of these samples have been analysed as yet.
This sample was taken was from Dernakesh Water Treatment Plant and was chosen because it was the site supplying the area from where the most complaints had been received.

The results of the sample of coagulant taken from Dernakesh identified unusual levels of phenol and acetic acid present (see table below). All other parameters were within the normal specification.

		CONTAMINATED PAC BATCH		QC PAC BATCH
Phenol Concentration (mg./l)		12500		55
Acetic acid concentration (mg./l)		175		175
Coagulant		PAC		PAC
Coagulant conc.(% w/v Al)		6.35		6.35
Volume of PAC product required		0.015748031		0.015748031
PAC Dose (mg.Al/l)	PAC dose (mls.product/l)	Phenol dose (mg./l raw water)	Acetic acid dose (mg./l raw water)	Phenol dose (mg./l raw water)
3	0.047244094	0.590551181	0.0082677	0.002598425
4	0.062992126	0.787401575	0.0110236	0.003464567
5	0.078740157	0.984251969	0.0137795	0.004330709
6	0.094488189	1.181102362	0.0165354	0.00519685
7	0.11023622	1.377952756	0.0192913	0.006062992
8	0.125984252	1.57480315	0.0220472	0.006929134
9	0.141732283	1.771653543	0.0248031	0.007795276
10	0.157480315	1.968503937	0.0275591	0.008661417

A check sample was also submitted for analysis at the same time, of note is the level of phenol in this sample which is still outside the required specification and this is being investigated further.

Working from this information, the presence of these contaminants could have resulted to the presence of the following levels in the treated water:

Parameter	**Calculated level in final water**				
	Bunnoe	Crosserlough	Dernakesh	Glaslough	Kill
Dose rate for PACl (mg/l Al)	6	7	6	10	6
Phenol (mg/l)	1.18	1.38	1.18	1.97	1.18
Acetic acid (mg/l)	0.016	0.019	0.016	0.028	0.016

The information we have regarding safe levels of these compounds as stated in UKWIR toxicology can be found below as a synopsis and also attached in the full datasheet. It is known that the phenol would react with chlorine to produce a highly noticeable taste and odour described as TCP which is consistent with the reports form the consumers.

Phenol Synopsis

Phenol is a widely used industrial compound of moderate oral acute toxicity to mammals. It is readily absorbed by all routes and is rapidly conjugated and eliminated in the urine. Signs of toxicity include damage to liver and kidney, cyanosis and respiratory failure when exposed at high doses. It does not appear to be mutagenic in the Ames test, but has given positive results in some higher test systems. Results from carcinogenicity studies have proved to be inconclusive. It appears that phenol is of low to moderate toxicity to aquatic organisms. Phenol is readily biodegraded during the processes of sewage treatment provided the organisms are allowed to acclimatise to the presence of an aromatic compound. A short-term operational SNARL of 10 µg/l is recommended for phenol based on organoleptic effects, whereas a 24hr health-based SNARL of 6 mg/l is proposed. However, following chlorination a lower operational short-term SNARL of 1 µg/l is recommended. This is due to the formation of a number of chlorophenols which have even lower organoleptic thresholds.

Acetic Acid Synopsis

Acetic acid is a naturally occurring metabolite found in the body and is also used widely as a food preservative (EEC No. E260). The Joint FAO/WHO Expert Committee on Food Additives and EC Scientific Committee for Food have considered it unnecessary to establish an ADI for acetic acid. It is of very low acute oral toxicity and there is no evidence that it has any reproductive, mutagenic or carcinogenic effects. Most toxic effects reported are due to the irritating and corrosive effects of the concentrated acid. It is of low toxicity to fish and also appears to be readily degraded by both aerobic and anaerobic degradation. The majority of its taste and odour thresholds range between 22

and 200 mg/l. However, there has been one report of an odour threshold value of 0.007 mg/l which suggests that there may be individuals in the population which are supersensitive to the odour of acetic acid. It is recommended that the SNARL be based on organoleptic effects.

Due to the process in place, chlorinated phenolic compounds and haloacetic acids may be formed. To determine if there are any of these substances present, the samples taken on 20 April for speciated phenols and 24 April 2007 have been analysed for these parameters. It is recognised that this is after a number of remedial steps have been made and therefore does not give an actual indication if these substances were present at the time the taste and odours were being experienced however they will provide evidence if any of these compounds are present in the treated water now.

On the basis of the above information, it is suggested that the criteria for lifting the do not drink notice could be:-

1. Replacement of suspected coagulant with new
2. Confirmation of evidence to confirm the absence of any products arising directly or indirectly from the possible contaminants by GC-MS, speciated phenols and H AA analysis
3. Three satisfactory sets for taste and odour for water leaving the treatment works and from representative selection of properties in the distribution system.

H Clay Chapman
Veolia Water Quality Advisor
26 April 2007

Appendix 2 East Cavan Water Scheme – summary of chemical test results

(Received with thanks from Cavan County Council – for further details see Cavan County Council report)

Date Sampled: 18/04/07

Number of samples: 4

Location of samples:

Scheme	Location	Sample Number
Dernakesh	Maudabawn reservoir	0721/0542
Kill	Kill national school	0721/0543
Bunnoe	Bunnoe school	0721/0544
Crosserlough	Post office	0721/0545

Parameters Analysed:

- PAH
- Total Phenols by HPLC
- Antimony
- Arsenic
- Chromium
- Copper
- Formaldehyde
- Phenols by MS
- Semi Volatile Organics plus TICS

Results: 1 Exceedence

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Dernakesh	Maudabawn reservoir	0721/0542	**Antimony**	**11ug/l**	**10ug/l**

Dernakesh GWS was sampled again on the 14/05/2007. Antimony was below the MAC the result was <1ug/l.

East Cavan Water Scheme

Date Sampled: 31/03/07 This was sampled by the group scheme. This sample was given to Cavan County Council and sent for analysis on receipt of the sample, on the 23 of april 2007

Number of samples: 1

Location of samples:

Scheme	Location	Sample Number
Dernakesh	Reservoir	0721/0555

Parameters Analysed:

- PAH
- Formaldehyde
- Semi Volatile Organics plus TICS

Results:

Exceedances

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Dernakesh	reservoir	0721/0555	**Benzo(a) pyrene**	**97ng/l**	**10ng/l**
Dernakesh	reservoir	0721/0555	**PAHs**	**286ng/l**	**100ng/l**

There were also high levels of other PAHs found, but these do not have a MAC values

- **This sample was sent again for analysis for PAHs on the 29th of May 2007 to the same laboratory Alcontrol and there were no exceedances recorded. The laboratory could not give an explanation for these results**

- **A final portion of this sample was sent for analysis to Mountainheath laboratories in England, the limit of detection for the individual PAHs was higher at 20ng/l, and though no exceedenances for the 4 specified compounds were recorded there was 100ng/l levels of Naphthalene recorded indicating the presences of PAHs**

REPEAT ANALYSIS

East Cavan Water Scheme

Date Sampled: 31/03/07

Number of samples: 1

Location of samples:

Scheme	Location	Sample Number
Dernakesh Reservoir	Reservoir **(Test Repeated)**	0721/0696(actually 0721/0555)

Parameters Analysed:

- PAH EPA

Results:
No exceedances

REPEAT ANALYSIS

East Cavan Water Scheme

Date Sampled: 31/03/07

Number of samples: 1

Location of samples:

Scheme	Location	Sample Number
Dernakesh Reservoir	Reservoir **(Test Repeated)**	0721/0555 Sent to Mountainheath

		labs

Parameters Analysed:

- PAH EPA

Results:

- **A final portion of this sample was sent for analysis to Mountainheath laboratories in England, the limit of detection for the individual PAHs was higher at 20ng/l, and though no exceedenances for the 4 specified compounds were recorded there was 100ng/l levels of Naphthalene recorded indicating the presences of PAHs**

East Cavan Water Scheme

Date Sampled: 23/04/07

Number of samples: 5

Location of samples:

Scheme	Location	Sample Number
Bunnoe	Reservoir	0721/0556
Bunnoe	Drum (farmhouse)	0721/0557
Kill	Kill church	0721/0558
Dernakesh	Maudabawn (House)	0721/0559
Crosserlough	House in Drumcassidy	0721/0560

Parameters Analysed:

- PAH EPA
- Formaldehyde
- Semi Volatile Organics plus TICS

Results:

Exceedances

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Bunnoe*	Drum	0721/0557	**Benzo(a)**	**11ng/l**	**10ng/l**

	(Farmhouse)		**pyrene**		
Kill*	Kill church	0721/0558	**PAHs**	**276ng/l**	**100ng/l**

- **Both these samples were identified as having decanes present**
- **All samples with the exception of 07210556 had high levels of particular PAHs, but these particular PAHs do not have a MAC values**

REPEAT ANALYSIS

East Cavan Water Scheme

Date Sampled: 23/04/07 See note on originals samples

Number of samples: 4

Location of samples:

Scheme	Location	Sample Number
Bunnoe	Reservoir **(Test Repeated)**	0721/0695
Bunnoe	Drum Farmhouse **(Test Repeated)**	0721/0694
Kill	Kill church **(Test Repeated)**	0721/0693
Crosserlough	House in Drumcassidy **(Test Repeated)**	0721/0692

Parameters Analysed:

- PAH EPA

Results:
No exceedances

East Cavan Water Scheme

Date Sampled: 24/04/07

Number of samples: 5

Location of samples:

Scheme	Location	Sample Number
Kill	Drumhurt	0721/0569
Dernakesh	Maudabawn (Post office)	0721/0570
Bunnoe	Lisbree	0721/0571
Crosserlough	Aughnagegra	0721/0572
Mountain lodge	Knocknashammer	0721/0573

Parameters Analysed:

- Volatile Fatty Acids
- Alcohols/Acetates
- PAH
- Phenols by MS
- Semi Volatile Organics plus TICS
- Volatile Organic Compounds plus TICS
- Aluminium Low level
- Acetone

Results:

Exceedances

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Crosserlough	Aughnagegra	0721/0572	**Aluminium**	**1127ug/l**	**200ug/l**

East Cavan Water Scheme

Date Sampled: 15/04/07, This was sampled by the group scheme and sent for analysis on receipt on the 26th of April 2007.

Number of samples: 1

Location of samples:

Scheme	Location	Sample Number
Dernakesh	House	0721/0579

Parameters Analysed:

- Phenols by MS

- Aluminium

Results:
No exceedances

East Cavan Water Scheme

Date Sampled: 30/04/07

Number of samples: 5

Location of samples:

Scheme	Location	Sample Number
Bunnoe	House	0721/0591
Kill	House Carnabeagh	0721/0592
Dernakesh	PO Maudabawn	0721/0593
Mountain lodge	Canning's town P.O.	0721/0594
Crosserlough	House	0721/0595

Parameters Analysed:

- DRO + Mineral oil by GC
- DRO Interpretation
- PAH EPA
- Phenols by MS
- Semi Volatile Organics plus TICS
- Speciated Phenols by HPLC
- Aluminium

Results:

Exceedances

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Kill	Carnabeagh	0721/0592	**Aluminium**	**270ug/l**	**200ug/l**

East Cavan Water Scheme

Date Sampled: 03/05/07

Number of samples: 10

Location of samples:

Scheme	Location	Sample Number
Bunnoe	House	0721/0610
Bunnoe	Reservoir	0721/0611
Kill	House	0721/0612
Kill	Reservoir	0721/0613
Dernakesh	Maudabawn	0721/0614
Dernakesh	Reservoir	0721/0615
Drumkeery	Cannaragh	0721/0616
Crosserlough	House	0721/0617
Crosserlough	Reservoir	0721/0618
Billis/Lavey	Latnadronagh	0721/0619

Parameters Analysed:

- BTEX
- PAH EPA
- Semi Volatile Organics plus TICS
- THM Suite Potable
- Speciated Phenols by HPLC
- Total Phenols by HPLC
- Dissolved Aluminium Low Level

Results:

No exceedences

East Cavan Water Scheme

Date Sampled: 08/05/07

Number of samples: 12

Location of samples:

Scheme	Location	Sample Number
Crosserlough	Aughadronag	0721/0631
Crosserlough	Kilnacrott	0721/0632
Crosserlough	Derrylahan	0721/0633
Kill	Drumerkillew	0721/0634
Kill	Drumsernney	0721/0635
Kill	Annalee	0721/0636
Bunnoe	House	0721/0637
Bunnoe	Eanagh	0721/0638
Bunnoe	Lisbree	0721/0639
Dernakesh	house	0721/0640
Dernakesh	Mullan	0721/0641
Dernakesh	Corranurnuey	0721/0642

Parameters Analysed:

- BTEX
- PAH EPA
- Semi Volatile Organics plus TICS
- THM Suite Potable
- Speciated Phenols by HPLC
- Total Phenols by HPLC
- Dissolved Aluminium Low Level

Results:

Exceedances

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Crosserlough	Aughadronag	0721/0631	**Aluminium**	**249ug/l**	**200ug/l**

Crosserlough	Kilnacrott	0721/0632	**Aluminium**	**906**	**200**
Crosserlough	Derrylahan	0721/0633	**Aluminium**	**214**	**200**
Dernakesh	Corranurnuey	0721/0642	**Aluminium**	**326**	**200**

Note Phenol was found in one sample 0721/0635 but this was not above the MAC

East Cavan Water Scheme

Date Sampled: 14th May 2007

Number of samples: 1

Location of samples:

Scheme	Location	Sample Number
Dernakesh	House	

Aluminium exceedance 209ug/l
Parameters Analysed:

Aluminium
Iron
Manganese
Lead
Antimony

Results:

Exceedances

Scheme	Location	Sample Number	Exceedance Parameter	Concentration	Maximum Admissable Concentration
Dernakesh	House		**Aluminium**	**209**	**200**

East Cavan Water Scheme

Date Sampled: Early July

Number of samples: 1

Location of samples:

Scheme	Location	Sample Number
Crosserlough Resevoir Dirty Washout Water	Washwater from resevoir	0721/0850

Parameters Analysed:

DRO
BTEX
PAH EPA (16)
Semi Volatile Organics plus TICS
Speciated Phenols
Nonyl phenol
Acetic acid

Results:

Exceedances

Exceedances were not available for the following paramters as there is no MAC available and this was not drinking water.
However there were levels of the following compounds found in this sample

Nonylphenol	2.2ug/l
Naphthalene	0.02ug/l
o-cresol (2-methylphenol)	0.11ug/l
p-cresol (4-methylphenol)	0.39ug/l
Phenol	25ug/l
bis(2-ethylhexyl) phthalate	19ug/l
di-n-butyl phthalate	0.27ug/l
Acetic acid	1100mg/l

Treatment chemicals PAC samples

East Cavan Water Scheme

Date Sampled: 24/07/07

Number of samples: 7

Location of samples:

Scheme	Location	Sample Number
Dernakesh GWS	PAC sample IBC	0721/0879
Crosserlough GWS	PAC sample IBC 15	0721/0880
	PAC sample Unused IBC 22	0721/0881
	PAC sample Unused IBC 26	0721/0882
Mountain Lodge GWS	PAC sample IBC 43	0721/0883
Billis/Lavey GWS	PAC sample IBC 53	0721/0884
Drumkerry GWS	PAC sample IBC 57	0721/0885

Parameters Analysed:

DRO
BTEX
PAH EPA (16)
Semi Volatile Organics plus TICS
Speciated Phenols
Nonyl phenol
Acetic acid

Results:

- **Exceedances were not available for the following parameters as there is no MAC available and this was not drinking water.**
- **However there were levels of the following compounds found in this sample**

	0721/0879 ug/l	0721/0880 ug/l	0721/0881 ug/l	0721/0882 ug/l	0721/0883 ug/l	0721/0884 ug/l	0721/0885 ug/l
Diesel range organics	13000	12000	35000		8400	3900	19000
Benzene	0.2		0.5				
M- &p-xylene		0.3	0.3				
2,3,4,6,-tetrachlorophenol	0.8						
2,3,4 trichlorophenol	0.42						
2,3,5,6 tetrachlorophenol	2.1						
2,4,5 trichlorophenol	0.77						
2,4,6 trichlorophenol	0.88	0.45			2.4	0.68	1.8
Toluene	5.2	111	2.9	14.9	13.8	14.3	22
Nonylphenol	13	14	16	660	11	19.0	9.5
Naphthalene							
2, chlorophenol	1.5	0.99	1.20	0.34	2.90	3.00	1.9
o-cresol (2-methylphenol)	0.73	0.61	1.10	0.45	1.10	1.90	0.58
p-cresol (4-methylphenol)	3.4	2.4	6.6	1.30	4.40	13.0	2.3
Phenol	6400	5400	6400	3900	5400	5000	4300
bis(2-chloroethoxy)methan							
di-n-butyl phthalate	0.37	0.29	0.71	0.65	0.7	0.31	0.27
Acetic acid	5600	5200	5200	6400	5900	5900	5600
Bis(2-ethylhexyl)phthalat	1.00	0.62	13.0	2.6	3.5	0.56	0.5

Appendix 3 Glaslough/Tyholland Scheme – summary of chemical test results

(Received with thanks from Monaghan County Council – for further details see Monaghan County Council report)

Glaslough / Thyholland GWS . Record Of Results. Updated 25-07-2007

DATE	LOCATION	SAMPLE TYPE	Cl.	STATUS	RESULT	COMMENT
19-02-07	Rossarell	Check	nm	Final	**Aluminium 0.45 mg/**	**UNSAT.**
06-03-07	Rossarell	Check	0.18	Final	**Aluminium 0.547mg/l**	**UNSAT.**
23-03-07	Killymarley	Check		Final	**Aluminium 0.365mg/l Iron 474.8**	**UNSAT.**
03-04-07	Works	Audit	0.07	Interim	**Aluminium 0.268mg/l**	**UNSAT.**
12-04-07	B.D. Foods	Check	0.07	Final		Satisfactory
16-04-07	Reservoir LR(1142)	C1C	0.14	Final		Satisfactory
	Rossarrell LR(1143)	C1C	0.05	Final		Satisfactory
	Thyholland LR1144	C1C	<0.05	Final		Satisfactory
17-04-07	Reservoir LR(1145)	Phenols		Final	<0.01mg/l	Satisfactory
		PAH's		Final	<10ng/l	Satisfactory
				2,4,6-trichlorophenol	**2.9ug/l**	**UNSAT.**
20-04-07	Reservoir LR(1227)	Phenols		Final	<0.01mg/l	Satisfactory
		PAH's		Final	<0.01ug/l	Satisfactory
	B.D. Foods LR(1228)	Phenols		Final	<0.01mg/l	Satisfactory
		PAH's		Final	<0.01ug/l	Satisfactory
	Thyholland LR(1229)	Phenols		Final	<0.01mg/l	Satisfactory

		PAH's		Final	<0.01ug/l	Satisfactory
DATE	LOCATION	SAMPLE TYPE	Cl.	STATUS	RESULT	COMMENT
23-04-07	(Clontibret Water) LR(1246)	Phenols PAH's	 N/A	Final Final	<0.0005mg/l <0.01ug/l	Satisfactory Satisfactory
	Rossarrell (Well Water) LR(1245)	Phenols PAH's	 0.02	Final Final	<0.0005mg/l <0.01ug/l	Satisfactory Satisfactory
	Resevoir (Well Water) LR(1242)	Phenols PAH's	 0.02	Final Final	<0.0005mg/l <0.01ug/l	Satisfactory Satisfactory
	Thyholland (Well Water) LR(1244)	C1C Phenols PAH's Phenols PAH's	 0.11 ------ 0.08	Final Final Final Final Final	 <0.0005mg/l <0.01ug/l <0.0005mg/l <0.01ug/l	Satisfactory Satisfactory Satisfactory Satisfactory Satisfactory
24-04-07	(Clontibret Water) LR(1250)	Phenols PAH's C1C	------- 0.02	Final Final Final	<0.0005mg/l <0.01ug/l	Satisfactory Satisfactory Satisfactory
	Hillhall (Well Water) LR(1248)	Phenols PAH's	------- 	Final Final	<0.0005mg/l <0.01ug/l	Satisfactory Satisfactory
	Reservoir (Well Water) LR(1247)	C1C Phenols PAH's	0.07 -------	Final Final Final	 <0.0005mg/l <0.01ug/l	Satisfactory Satisfactory Satisfactory
	Thyholland (Well Water) LR(1249)	Phenols PAH's	-------	Final Final	<0.0005mg/l <0.01ug/l	Satisfactory Satisfactory

25-04-07	Rossarrell (Well Water) LR(1255)	Phenols	-------	Final	<0.01mg/l	Satisfactory
	Reservoir (Well Water) LR(1253)	C1C	0.03	Final		Satisfactory
		Phenols	-------	Final	<0.01mg/l	Satisfactory
	Thyholland (Well Water) LR(1254)	C1C	0.02	Final		Satisfactory
		Phenols	-------	Final	<0.01mg/l	Satisfactory
DATE	LOCATION	SAMPLE TYPE	Cl.	STATUS	RESULT	COMMENT
26-04-07	Rossarrell (Well Water) LR(1288)	Phenols	-------	Final	**0.09mg/l Total Phenols**	**UNSAT.**
	Reservoir (Well Water) LR(1287)	Phenols	-------	Final	<0.01mg/l	Satisfactory
	Thyholland (Well Water) LR(1290)	Phenols	-------	Final	**0.17mg/l Total Phenols**	**UNSAT.**
	Hillhall (Well Water) LR(1289)	Phenols	-------	Final	**0.21mg/l Total Phenols**	**UNSAT.**
01-05-07	Rossarrell (Well Water) LR(1373)	Phenols	-------	Final	<0.01mg/l	Satisfactory
		PAH's	-------	Final	<0.01ug/l	Satisfactory
	Reservoir (Well Water) LR(1371)	Phenols	--------	Final	<0.01mg/l	Satisfactory
		PAH's	-------	Final	<0.01ug/l	Satisfactory
	Thyholland (Well Water) LR(1372)	Phenols	--------	Final	<0.01mg/l	Satisfactory
		PAH's	---------	Final	<0.01ug/l	Satisfactory
02-05-07	PAC2 At treatment plant LR(1374)	Phenols		Final	<0.01mg/l	Satisfactory
		Aluminium	--------	Final	65,123mg/l.	

	Water in rising main LR(1375)	PAH'S	---------	Final	<0.01ug/l	Satisfactory
		Phenols		Final	<0.01mg/l	Satisfactory
		Aluminium		Final	**0.811mg/l**	**UNSAT.**
		PAH'S		Final	<0.01ug/l	Satisfactory

Appendix 4 Phenol – frequently asked questions.

(With thanks to the Agency for Toxic Substances and Diseases Registry (ATSDR), Atlanta, GA, USA)

ToxFAQs™
for
Phenol
September 2006

This fact sheet answers the most frequently asked health questions (FAQs) about phenol. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

Highlights

Phenol is both a manufactured chemical and a natural substance. Phenol is used as a disinfectant and is found in a number of consumer products. Skin exposure to high amounts can produce skin burns, liver damage, dark urine, irregular heart beat, and even death. Ingestion of concentrated phenol can produce internal burns. Phenol has been found in at least 595 of the 1,678 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is phenol?

Phenol is both a manufactured chemical and a natural substance. It is a colorless-to-white solid when pure. The commercial product is a liquid. Phenol has a distinct odor that is sickeningly sweet and tarry.

You can taste and smell phenol at levels lower than those that are associated with harmful effects. Phenol evaporates more slowly than water, and a moderate amount can form a solution with water. Phenol can catch fire.

Phenol is used primarily in the production of phenolic resins and in the manufacture of nylon and other synthetic fibers. It is also used in slimicides (chemicals that kill bacteria and fungi in slimes), as a disinfectant and antiseptic, and in medicinal preparations such as mouthwash and sore throat lozenges.

What happens to phenol when it enters the environment?

- Following small, single releases, phenol is rapidly removed from the air (generally, half is removed in less than a day).
- Phenol generally remains in the soil only about 2 to 5 days.
- Phenol can remain in water for a week or more.
- Larger or repeated releases of phenol can remain in the air, water, and soil for much longer periods of time.
- Small amounts of phenol may be found in organisms that live in contaminated water.
- Phenol does not build up in fish, other animals, or plants.

How might I be exposed to phenol?

- You may be exposed to phenol if you live near landfills or hazardous waste sites that contain phenol or near facilities manufacturing phenol.
- You may be exposed to very low levels in your home because it is found in a number of consumer products, including mouthwashes, gargles, and throat lozenges.
- You may be exposed to phenol if you undergo “chemical peels” to remove skin lesions with phenol-containing products or are treated for chronic pain or spasticity with injections of phenol.
- Low levels of phenol are found in some foods, including smoked summer sausage, fried chicken, mountain cheese, and some species of fish.
- Smoking or inhaling second hand smoke will expose you to phenol.
- Low levels of phenol can be present in air and drinking water.

How can phenol affect my health?

Short-term exposure to phenol in the air can cause respiratory irritation, headaches, and burning eyes. People who had skin exposure to high amounts of phenol had skin burns, liver damage, dark urine, irregular heart beat, and some died. Ingestion of high concentrations of phenol has resulted in internal burns and death. The effects of prolonged exposure to low levels of phenol in air or of ingestion of low levels of phenol

are uncertain because almost always there has been simultaneous exposure to other chemicals.

In animals, breathing air with high levels of phenol resulted in irritation of the lungs. Repeated exposures induced muscle tremors and loss of coordination. Exposure to high concentrations of phenol in the air for several weeks caused paralysis and severe injury to the heart, liver, kidneys, and lungs, and in some cases, death. Some animals that drank water with very high concentrations of phenol suffered muscle tremors and loss of coordination.

Phenol can have beneficial effects when used medically as an antiseptic or anesthetic.

How likely is phenol to cause cancer?

It is not known if phenol causes cancer in humans. Cancer developed in mice when phenol was applied to the skin several times per week for the lifetime of the animal. Phenol did not cause cancer in mice or rats that drank water containing it for 2 years. The International Agency for Research on Cancer (IARC) and the EPA have determined that phenol is not classifiable as to its carcinogenicity to humans.

How can phenol affect children?

Children are exposed to phenol in the same way adults are, except for exposures of adults at work. However, children are at greater risk of accidentally ingesting or spilling on their skin home products that contain phenol. Vomiting and lethargy were the most frequent signs of toxicity observed in children who accidentally ingested phenol and were treated at a poison control center.

Phenol has caused minor birth defects and low birth weight in animals generally at exposure levels that also were toxic to the pregnant mothers.

How can families reduce the risks of exposure to phenol?

- Avoiding environmental tobacco smoke, which contains phenol, will reduce phenol exposures.
- Always store household products and over-the-counter medications that contain phenol in their original labeled containers out of the reach of children.

Is there a medical test to determine whether I've been exposed to phenol?

There is a urine test that can tell if you have been exposed to phenol recently (within 1 or 2 days). However, the test cannot tell if you were exposed only to phenol because many substances are converted to phenol in the body. The test also cannot tell whether adverse health effects might result from the exposure. The test for phenol is not routinely performed at your doctor's office, but your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA lifetime health advisory for phenol in water is 2 milligrams per liter (2 mg/L). EPA requires that spills of 1,000 pounds or more of phenol to the environment be reported to the Agency.

The Occupational Safety and Health Administration (OSHA) has set a limit of 5 parts per million (ppm) in air to protect workers during 8-hour work shifts.

The National Institute for Occupational Safety and Health (NIOSH) recommends a limit of 5 ppm for phenol in workroom air over a 10-hour workday and that the concentration of phenol should not exceed 16 ppm during a 15-minute period.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Phenol (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
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Appendix 5 Chlorophenols – frequently asked questions.

(With thanks to the Agency for Toxic Substances and Diseases Registry (ATSDR), Atlanta, GA, USA)

ToxFAQs™
for
Chlorophenols

June 1999

This fact sheet answers the most frequently asked health questions about chlorophenols. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

Highlights

Chlorophenols are a group of compounds that are used in a number of industries and products. Exposure to high levels can cause damage to the liver and immune system. These substances have been found in at least 166 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are chlorophenols?

Chlorophenols are a group of chemicals that are produced by adding chlorines to phenol. Phenol is an aromatic compound derived from benzene. There are 5 basic types of chlorophenols and 19 different chlorophenols.

Most chlorophenols are solid at room temperature. They have a strong, medicinal taste and smell. Small amounts can be tasted in water.

Some chlorophenols are used as pesticides. Others are used in antiseptics. Small amounts are produced when water is disinfected with chlorine. They are also produced while bleaching wood pulp with chlorine to make paper.

What happens to chlorophenols when they enters the environment?

- Chlorophenols can enter the environment when they are being made or used as pesticides.
- Most chlorophenols released to the environment go into water.
- Small amounts of chlorophenols enter the air.
- In the air, sunlight helps destroy these compounds and rain washes them out of the air.
- Chlorophenols stick to soil and sediments at the bottom of lakes, streams, and rivers.
- Low levels of chlorophenols in water, soil, or sediment are broken down and removed from the environment in a few days to weeks by microorganisms.

How might I be exposed to chlorophenols?

- Most people are exposed to very low levels of chlorophenols in chlorinated drinking water.
- There are some chlorophenols in city air.
- You can be exposed if you work with chlorophenols or use them as pesticides.
- You can be exposed if you make or use treated wood.

How can chlorophenols affect my health?

Workers exposed to pesticides that contain chlorophenols have developed acne and mild injury to their livers.

In laboratory studies, animals that received high levels of chlorophenols in food or water developed liver and immune system effects. They did not gain as much weight as animals not fed the compounds.

High levels of chlorophenols given to pregnant female rats in their drinking water reduced the number of babies they had, and caused low birth weights. Chlorophenols have not been shown to cause birth defects in animals.

How likely are chlorophenols to cause cancer?

There is evidence to suggest that people exposed to chlorophenols for a long time may have slightly higher incidences of cancer. However, the people studied were exposed to other chemicals as well.

In animal studies, one chlorophenol, 2,4,6-trichlorophenol, caused leukemia in rats and liver cancer in mice. The Department of Health and Human Services (DHHS) has determined that 2,4,6-trichlorophenol may reasonably be anticipated to be a carcinogen.

How can chlorophenols affect children?

Children can be exposed in the same ways as adults; however, children may be more sensitive than adults to the effects of chlorophenol-based pesticides and herbicides. Chlorophenols leave the body quickly, so they are not likely to accumulate in the mother's tissues or breast milk.

There are no human studies on the effects of chlorophenols on developing fetuses. Studies in rats showed that chlorophenols can pass through the placenta and produce toxic effects to the developing fetuses. The most common problems are delayed hardening of the bones of the breastbone, spine, and skull.

How can families reduce the risk of exposure to chlorophenols?

Parents should keep children away from areas where chlorophenols have been used as pesticides. Always check labels on household products, and store them safely in their original containers. Never store chemicals in containers that children might find attractive to eat or drink from, such as soda bottles.

Is there a medical test to show whether I've been exposed to chlorophenols?

There is no test to show if you have been exposed to chlorophenols. There are tests for certain compounds that are produced in your body when chlorophenols break down. However, exposure to other substances could also produce the same test results.

Has the federal government made recommendations to protect human health?

EPA recommends that drinking water contain no more than 0.04 milligrams per liter (0.04 mg/L) of 2-chlorophenol for a lifetime exposure for an adult, and 0.05 mg/L for a 1-day, 10-day, or longer exposure for a child.

For 2,4-dichlorophenol, EPA recommends that drinking water contain no more than 0.03 mg/L for a 1-day, 10-day, or longer exposure for a child.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological Profile for Chlorophenols. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
Email: cdcinfo@cdc.gov

Appendix 6 Polycyclic Aromatic Hydrocarbons – frequently asked questions.

(With thanks to the Agency for Toxic Substances and Diseases Registry (ATSDR), Atlanta, GA, USA)

ToxFAQs™
for
Polycyclic Aromatic Hydrocarbons (PAHs)
September 1996

This fact sheet answers the most frequently asked health questions about polycyclic aromatic hydrocarbons (PAHs). This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

Highlights

Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons (PAHs)?

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to polycyclic aromatic hydrocarbons (PAHs) when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to polycyclic aromatic hydrocarbons (PAHs)?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can polycyclic aromatic hydrocarbons (PAHs) affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are polycyclic aromatic hydrocarbons (PAHs) to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to polycyclic aromatic hydrocarbons (PAHs)?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour

workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
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FAX: 770-488-4178
Email: cdcinfo@cdc.gov