

UK Technical Advisory Group on the Water Framework Directive

Technical report on Groundwater Hazardous Substances

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This technical report results from a UKTAG project reviewing approaches to the implementation of the Groundwater Directive across the United Kingdom. The focus was on specific hazardous substances aspects of the Groundwater Directive. This paper provides a common technical framework to assist each part of the UK in developing and refining their approaches to monitoring, assessing and controlling risks to groundwater.

Each administration will consequently set out their regulatory position individually, informed by the technical work as set out in this paper, based on the regulations operating within each administration. If appropriate this may include a public consultation, which will be undertaken separately by each administration.

1. Purpose

This technical report sets out the advice of the UK Technical Advisory Group on the Water Framework Directive on:

- the current laboratory limits of quantification for a range of hazardous pollutants in groundwater; and
- concentrations in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided.

The advice is intended to assist the member agencies of UKTAG in planning and prioritising their approaches to monitoring, assessing and managing risks to groundwater resources.

Because of the different regulatory regimes operating within the United Kingdom, decisions on how this technical guidance is implemented will need to reflect each agency's particular circumstances and needs.

Table 1 lists the:

- laboratory limits of quantification available in 2016 for a range of hazardous pollutants; and
- concentrations in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided.

Further information on how risks to groundwater from hazardous pollutants are managed is available from the relevant agency:

Country	Relevant agency
Wales	Natural Resources Wales
England	Environment Agency
Northern Ireland	Northern Ireland Environment Agency
Scotland	Scottish Environment Protection Agency

Table 1: UKTAG values for hazardous substances

Substance^{1*}	CAS Registry No	Limit of quantification² (2016) in µg/l	Concentrations in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided³ (an annual mean µg/l)
Acrylamide	79-06-1	0.04	0.05
Alkanes, C10–13, chloro	085535-84-8	<i>Not ascertained⁴</i>	105
Anthracene	000120-12-7	0.01	0.05
Arsenic	7440-38-2	5	5
Benzene	000071-43-2	0.2	0.5
Benzo(a)pyrene	000050-32-8	0.00005	0.005
Benzo(b)fluoranthene	000205-99-2	0.00005	0.05
Benzo(g,h,i)perylene	000191-24-2	0.00005	0.05
Benzo(k)fluoranthene	000207-08-9	0.00005	0.05
Chloroethylene / (Vinyl Chloride)	000075-01-4	0.2	0.25
Chromium(VI)	18540-29-9	1	5
Dioxins	NA - group substances	0.000001	0.000015
Hexabromocyclododecane (HBCDD)	25637-99-4	0.0005	350
Hexachlorobenzene	000118-74-1	0.0002	0.05
Hexachlorobutadiene (HCBd)	000087-68-3	0.0002	0.05
Hexachlorocyclohexane	000058-89-9	0.0002	0.05
Indeno(1,2,3-cd)pyrene	000193-39-5	0.00004	0.05
Lead	7439-92-1	0.2	5
Mercury compounds	NA - group substances	0.02	0.5
Perfluorooctane sulfonic acid and its salts (PFOS)	1763-23-1	0.0002	1
Pentachlorobenzene	000608-93-5	0.0002	2
Tributyltin oxide (TBTO)	000056-35-9	0.0004	1
Trichloroethylene	000079-01-6	0.2	5
1,2,4-trichlorobenzene	000120-82-1	0.0002	35
2,4-dichlorophenol	000120-83-2	0.05	100
2-chlorophenol	000095-57-8	0.05	150
4-chloro-3-methylphenol	000059-50-7	0.05	350

¹ Substances determined as hazardous by Joint Agencies Groundwater Determinations Advisory Group. This includes those reviewed in 2016. (<http://www.wfduk.org/stakeholders/methodology-determination-hazardous-substances>)

² Refer to Section 2.1

³ Refer to Section 2.2

⁴ No method was reported by EA laboratories in 2016. Note that the freshwater quality standard is 0.4 µg/l

Table 1: UKTAG values for hazardous substances

Substance^{1*}	CAS Registry No	Limit of quantification² (2016) in µg/l	Concentrations in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided³ (an annual mean µg/l)
Aldrin	000309-00-2, 085422-92-0; 063449-	0.0002	0.015
Atrazine	001912-24-9	0.0002	0.05
Azinphos ethyl	002642-71-9	0.012	0.05
Azinphos methyl	000086-50-0	0.006	0.05
Carbon tetrachloride	000056-23-5	0.2	1.5
Chlorfenvinphos	000470-90-6	0.0002	0.05
Chloroform	000067-66-3	0.2	50
Chloronitrotoluene	000121-86-8	2	<i>Not ascertained⁵</i>
DDT	000050-29-3	0.0002	0.05
Demeton-S-methyl sulphone	017040-19-6	<i>Not ascertained⁶</i>	0.05
Diazinon	000333-41-5	0.0002	0.05
Dieldrin	000060-57-1	0.0002	0.015
Dimethoate	000060-51-5	0.0002	0.05
Endosulfan	000115-29-7	0.0002	10
Endrin	000072-20-8	0.0002	0.015
Fenitrothion	000122-14-5	0.0002	0.05
Fenthion	000055-38-9	0.016	0.05
Isodrin	000465-73-6	0.0002	0.015
Malathion	000121-75-5	0.0002	0.05
Mevinphos	007786-34-7	0.016	0.05
Parathion	000056-38-2	0.008	0.05
Parathion-methyl	000298-00-0	0.01	0.05
PCBs	1336-36-3(category)	0.003	0.25
Pentachlorophenol (PCP)	000087-86-5	0.05	0.05
Permethrin	052645-53-1	0.0001	0.05
Simazine	000122-34-9	0.0002	0.05
Toluene	000108-88-3	0.2	350
Trifluralin	001582-09-8	0.0002	0.05
Triphenyltin oxide (TPTO)	000076-87-9	0.01	1

⁵ The review described in Annex 1 could find no appropriate safe drinking water value for chloronitrotoluene. However, the substance is not considered to be discharged in significant quantities in the UK and therefore its determination as "hazardous" was not reviewed by JAGDAG in 2016. Its determination should be reviewed by JAGDAG in the next round. In the meantime, if required, a safe drinking water valued can be derived on a case by case basis.

⁶ No method was reported by EA laboratories in 2016. Note that the original minimum reporting value for this substance was 0.05 µg/l

2.0 Basis for recommendations

2.0 Background

Article 6 of the EU Groundwater Directive (2006/118/EC) requires very stringent controls on the inputs of hazardous substances to groundwater. This stringency means that it is helpful for UKTAG to provide an interpretation of a) laboratory capability and also b) concentrations in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided. These two sets of values are provided in Table 1. The remainder of this section explains the basis for these two sets of values.

2.1 Limits of quantification

The limits of quantification provided in Table 1 refer to the concentrations of the pollutants that can be reliably measured and quantified from samples of groundwater. They are based upon laboratory freshwater capability. If a substance can be measured in groundwater above these values then it can be demonstrated that an input to groundwater has occurred, provided that account has been taken of natural background levels.

The limits of quantification in Table 1 represent the best available values that the Environment Agency laboratories can reach at present and are based on the requirements of the QA/QC Directive⁷. This Directive indicates that minimum performance criteria for a limit of quantification should be equal to or below a value of 30 % of the relevant environmental quality standards. This is to ensure as far as is practicable that the 'true' result lies above or below the environmental standard taking into consideration the precision, bias, and other contributors to measurement uncertainty, inherent in all laboratory analytical results.

Limits of quantification may change over time as more advanced analytical techniques become available. UKTAG recommends that the limits identified in this report are reviewed and updated as necessary every 6 years to ensure that developments in analytical capability are reflected in assessments of water body status and programmes of measures.

The limits apply where the groundwater sample is otherwise uncontaminated. The analytical techniques may have higher limits of quantification where the sample contains a mix of other pollutants, particularly where that mix affects the clarity of the sample. Adjustments for this effect need to be made on a case by case basis, in accordance with agency-specific guidance.

⁷ Directive 2009/90/EC, "Technical specifications for chemical analysis and monitoring of water status". As laboratories continually seek to satisfy the requirements of the QA/QC directive on an ongoing basis, it is envisaged that the other Agency and commercial laboratories should be in a position to achieve the proposed values in conjunction with ongoing analytical procedure development programmes they are undertaking.

2.2 Concentrations in groundwater below which the danger of deterioration in the quality of the receiving groundwater is avoided

The concentrations provided in Table 1 are derived from 75% of the WFD threshold, where that threshold is used for the protection of groundwater as a long term drinking water resource⁸. This calculation has been derived from the concept of the starting point for trend reversal, as defined in the Groundwater Directive (2006/118/EC).

UKTAG considers that the danger of deterioration in the quality of the receiving groundwater would be avoided, provided concentrations in groundwater in the immediate vicinity of the input remain below the lower of:

- the values identified in Table 1 of this report; and
- the environmental standards for the pollutants concerned established for the associated surface water, as described in Box 1.

The basis of the drinking water values is provided in Annex 1. The values used for “EQS” in Box 1 should be taken from environmental standards established for fresh surface waters in each part of the UK.

Box 1: How to adjust standards in an associated fresh surface water to account for groundwater dilution

Criteria for the selection of standards for point source inputs are:

The lower of average annual EQS** x 0.1 x LD **OR** the no deterioration value

- LD = Local dilution = Average annual*** flow in river / average annual discharge from site
- Default Value = 50% DWV

Criteria for the selection of standards for diffuse inputs are:

The lower of average annual EQS** x 0.1 x LDD **OR** the “no deterioration value”

- LDD = Local dilution (diffuse) = total sub-catchment area* / area of input
- Default Value = 50% DWV

Notes

**The ‘sub-catchment’ is to be defined by each agency and may be a small proportion of a groundwater body, as deemed appropriate.*

****The annual average flow is used rather than baseflow or summer low flow. This is because the EQS values are assessed as an annual average.*

⁸ Following UKTAG guidance on groundwater thresholds, this calculation approximates to 50% of the equivalent safe drinking water value.
http://www.wfduk.org/sites/default/files/Media/Assessing%20the%20status%20of%20the%20water%20environment/UKTAG%20Paper%2011b%28i%29%20-%20Guidance%20on%20Groundwater%20Chemical%20Classification_FINAL_2802121%20v2.pdf

3.0 Factors to consider for implementation

It is stressed that there are different regulatory regimes operating within the United Kingdom. Therefore decisions on how the values in this technical report are implemented will need to reflect the particular circumstances and needs. This means that the values in this report are not the same as regulatory standards.

Annex 1: Safe Drinking Water Values

“Safe drinking water value” means:

- (a) the drinking water standard for the pollutant applicable under UK legislation, including legislation implementing the Drinking Water Directive;
- (b) if no standard has been established under (i), a standard specified in World Health Organisation (WHO) Guidelines for Drinking Water Quality;
- (c) if no standard has been established under (i) or (ii), a standard established following peer review by a national authority in another country; and
if no suitable standard is available via any of the above, an operational value adopted by the agencies based on the best available scientific information on the properties of the pollutant concerned.

Atkins consultants were commissioned in 2014 to produce drinking water values for a list of substances, using (a)-(c) above as a hierarchy. In addition, the Agencies derived drinking water values for a further four substances. Those values derived by Atkins were subsequently reviewed internally by the Agencies and were updated, with associated justification where necessary.

The results of the review are shown below.

Annex 1: Selection of safe drinking water values used in this report		
Substance	CAS No.	Derivation of values.
Acrylamide	79-06-1	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Alkanes, C10–13, chloro	085535-84-8	TDI (draft) provisionally established by the UK Committee on Toxicology of Chemicals in Food, Consumer Products and the Environment (CoT) for Short Chain Chlorinated Paraffins (SCCPs) (C10-C13).
Anthracene	000120-12-7	PAHs are assessed using UKDWS for combination of four compounds (benz(k)fluoranthene, benzo(b)fluoranthene), indeno(cd-1,2,3)pyrene, and benz(g,h,i)perylene. The Australian National Water Quality Management Strategy of 2011 Polycyclic Aromatic Hydrocarbon Factsheet states that data are inadequate for setting guidelines for other PAHs.
Arsenic	7440-38-2	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Benzene	000071-43-2	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Benzo(a)pyrene	000050-32-8	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Benzo(b)fluoroanthene	000205-99-2	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for the sum of benzo(b)fluoranthene, Benzo(k)fluoranthene, benzo[g,h,i]perylene and indeno[1,2,3-cd]pyrene.
Benzo(g,h,i)perylene	000191-24-2	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for the sum of benzo(b)fluoranthene, Benzo(k)fluoranthene, benzo[g,h,i]perylene and indeno[1,2,3-cd]pyrene.
Benzo(k)fluoranthene	000207-08-9	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for the sum of benzo(b)fluoranthene, Benzo(k)fluoranthene, benzo[g,h,i]perylene and indeno[1,2,3-cd]pyrene.
Chloroethylene / (Vinyl Chloride)	000075-01-4	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Chromium(VI)	18540-29-9	Although a value of 50 µg/l for Total Chromium (non-hazardous substance) is included in from 'The Water Supply (Water Quality Regulations 2010 2010 No.994(W.99), Water, England and Wales'; in relation to Chromium VI (hazardous substance) a value of 10 µg/l is taken from California Department of Public Health online Drinking Water Law Book (accessed June 2014).
Dioxins	NA - group substances	Value taken from 'United States Environmental Protection Agency, May 2009, National Primary Drinking Water Regulations'.

Annex 1: Selection of safe drinking water values used in this report

Substance	CAS No.	Derivation of values.
Hexabromocyclododecane (HBCDD)	25637-99-4	MoE derived by CoT in 2006 based on dietary intake data for hexabromocyclododecanes from the Food Standards Agency 2004 Total Dietary Study. Internal review by the EA indicated that whilst the proposed DWV was similar to a value that could be derived using information contained in EFSA (2011) and ECHA (2008); the approach was not directly comparable and therefore consultation was needed with Public Health bodies.
Hexachlorobenzene	000118-74-1	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Hexachlorobutadiene (HCBD)	000087-68-3	UK DWS for pesticides applied for individual substances not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Hexachlorocyclohexane	000058-89-9	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Indeno(1,2,3-cd)pyrene	000193-39-5	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for the sum of benzo(b)fluoranthene, Benzo(k)fluoranthene, benzo[g,h,i]perylene and indeno[1,2,3-cd]pyrene.
Lead	7439-92-1	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Mercury compounds	NA - group substances	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Perfluorooctane sulfonic acid and its salts (PFOS)	1763-23-1	Value is presented as an action level for water suppliers based on 10% of the TDI to 1 litre of drinking water consumed by a one year old 10kg child as per 'Guidance on the Water Supply (Water Quality) Regulations 2000/01. March 2012 Specific to PFOS (perfluorooctane sulphonate) and PFOA (perfluorooctanoic acid) concentrations in drinking water'. EA internal review identified health-based guideline recommended by COT. Note that this proposed DWV is higher than the action level adopted by the DWI in 2009 and consultation with the DWI is therefore recommended.
Pentachlorobenzene	000608-93-5	TDI based on assessment report by Health Canada in 1993. Value less than the Oral RfD (0.8 µg/mg bw/day) adopted by the USEPA.
Tributyltin oxide (TBTO)	000056-35-9	Value taken from 'Australian Government National Health and Medical Research Council. Australian Drinking Water Guidelines (2011) - Updated December 2013' as lowest reported value against 'Health Canada. Guidelines for Canadian Drinking Water Quality Summary'. Internal EA review identified a group TDI for organotin compounds including tributyltin, dibutyltin, triphenyltin, and di-n-octyltin.
Triphenyltin oxide (TPTO)	000076-87-9	"Group TDI established by EFSA in 2004 which applies to the sum of the concentrations of the compounds of tributyltin, dibutyltin, triphenyltin, and di-n-octyltin (DWV amended following review by EA and discovery of TDI calculation error)"
Trichloroethylene	000079-01-6	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for the sum of tetrachloroethene and trichloroethene.
1,2,4-trichlorobenzene	000120-82-1	Value taken from 'United States Environmental Protection Agency, May 2009, National Primary Drinking Water Regulations'.
2,4-dichlorophenol	000120-83-2	Value taken from 'Australian Government National Health and Medical Research Council. Australian Drinking Water Guidelines (2011) - Updated December 2013' as lowest reported value against 'Health Canada. Guidelines for Canadian Drinking Water Quality Summary Table. August 2012'.
2-chlorophenol	000095-57-8	Value taken from 'Australian Government National Health and Medical Research Council. Australian Drinking Water Guidelines (2011) - Updated December 2013'
4-chloro-3-methylphenol	000059-50-7	Insufficient toxicological data to reliably support the derivation of a health based guidance value. Following EA review, REACH recommendations and draft US EPA data results in a range of possible DWV from 700 - 6300 ug/l. The more stringent value is proposed as the DWV, with a recommendation for further consultation with Public Health bodies
Aldrin	000309-00-2, 085422-92-0; 063449-	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for aldrin, dieldrin, endrin and isodrin combined.
Atrazine	001912-24-9	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.

Annex 1: Selection of safe drinking water values used in this report

Substance	CAS No.	Derivation of values.
Azinphos ethyl	002642-71-9	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Azinphos methyl	000086-50-0	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Carbon tetrachloride	000056-23-5	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Chlorfenvinphos	000470-90-6	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Chloroform	000067-66-3	Value from the 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for Trihalomethanes sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane.
Chloronitrotoluene	000121-86-8	No data available other than UKTAG suggested value. Subsequent EA internal review could find no toxicological data for EFSA, REACH, ATSDR, US EPA, and WHO data sources. Recommendation is for further studies and consultation with Public Health bodies.
DDT	000050-29-3	UK DWS for pesticides applied for individual substances not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'.
Demeton-S-methyl sulphone	017040-19-6	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Diazinon	000333-41-5	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Dieldrin	000060-57-1	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for aldrin, dieldrin, endrin and isodrin combined. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Dimethoate	000060-51-5	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Endosulfan	000115-29-7	Value taken from "Australian Government National Health and Medical Research Council. Australian Drinking Water Guidelines (2011) - Updated December 2013'.
Endrin	000072-20-8	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for aldrin, dieldrin, endrin and isodrin combined. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Fenitrothion	000122-14-5	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Fenthion	000055-38-9	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Isodrin	000465-73-6	Value from 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales' for aldrin, dieldrin, endrin and isodrin combined.
Malathion	000121-75-5	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Mevinphos	007786-34-7	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Parathion	000056-38-2	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.

Annex 1: Selection of safe drinking water values used in this report

Substance	CAS No.	Derivation of values.
Parathion-methyl	000298-00-0	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
PCBs	1336-36-3 (category)	Value taken from 'United States Environmental Protection Agency, May 2009, National Primary Drinking Water Regulations'.
Pentachlorophenol (PCP)	000087-86-5	UK DWS for pesticides applied for individual substances not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Permethrin	052645-53-1	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Simazine	000122-34-9	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.
Toluene	000108-88-3	Value from 'World Health organization, 2011, Guidelines for Drinking-water Quality 4th Edition'
Trifluralin	001582-09-8	UK DWS for pesticides applied for 'other pesticides' not including aldrin, dieldrin, endrin and isodrin as per 'The Water Supply (Water Quality) Regulations 2010 2010 No.994(W.99), Water, England and Wales'. It should be noted that Total Pesticides should not exceed 0.5 µg/L as per the Water Supply (Water Quality Regulations) 2010.