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Information about your groundwater quality analysis results



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This is a list of all the parameters analysed for in groundwater samples from the Environment Agency's groundwater quality network in England and Wales. Information on the parameter source and environmental fate, and where possible a drinking water standard or guideline value is provided, as well as the range of concentrations we've measured in groundwater.

Background information

Groundwater is important. It underlies much of England and Wales and provides over 33% of public drinking water supply (over 70% in the south-east of England), keeps our rivers flowing and is needed for the survival of many wetland habitats.

The Environment Agency monitors groundwater quality by sampling at a network of privately owned boreholes, wells and springs across England and Wales. We do this to:

- Find out what groundwater quality is like and how it's changing in our aquifers,
- Identify how groundwater, surface water and land based ecosystems are linked,
- Protect groundwater quality and manage how much we can take so that rivers, streams and wetlands and the animals and plants that live in them are not damaged

We have to do all of these things to make sure that people and the environment have enough water to meet our current and future needs and to comply with UK and European law.

We offer sites holders of the boreholes, wells and springs on the network a free copy of the results of the groundwater analyses. The information in this document has been put together to help site owners interpret the results we provide. All the parameters we could analyse for in groundwater are listed. The list includes both natural and man-made substances.

No site will have samples analysed for all the substances listed because we only analyse for those we need to monitor for at a particular site. For example, we wouldn't monitor for a man-made chemical in groundwater if we determined that this chemical had not been used or stored in the area being monitored and so there were no risks to groundwater. This is called risk-based monitoring and allows us to target our monitoring in the most cost-efficient way possible whilst ensuring we can meet our objectives and information needs.

How to use this document

The chemicals parameters are listed in alphabetic order. For each parameter a water quality standard is provided. Where available the Drinking Water Standards, as published by the Drinking Water Inspectorate (DWI) in the Water Supply (Water Quality) Regulations 2006, are shown. If a standard is not available a United States Environmental Protection Agency (USEPA) or World Health Organisation (WHO) drinking water guideline value is provided to indicate if results should be of concern. A range of concentrations for each chemical is given, based on results from our national monitoring programme between 1997 and 2005. Where a range isn't given then measurable concentrations of the chemical have not been detected at the time of writing. The natural concentration of man-made organic chemicals in groundwater should be zero, although some man-made chemicals e.g. phenol, also occur naturally.

Where possible we've provided information on how the chemical is used and how long it will remain in groundwater for. The information in this document is taken from the following sources:

UK Drinking Water Inspectorate (DWI) Drinking Water Standards and Science

<http://www.dwi.gov.uk/pubs/annrep05/contents.shtm>

World Health Organisation (WHO) health based guidelines for drinking water (2001 - 2003)

http://www.who.int/water_sanitation_health/dwq/en/

United States Environmental Protection Agency (USEPA)

<http://www.epa.gov/safewater/index.html>

Canadian Environmental Protection Agency (Canadian EPA) drinking water quality guidelines

<http://www.hc-sc.gc.ca/hecs-sesc/water/dwgsup.htm>

UK Environment Agency Pesticides Handbook, European Union Guidelines on Drinking Water Quality and the Extension Toxicology Network of Cornell University, Oregon State University, the University of Idaho, and the University of California.

What if concentrations at my site exceed a standard?

The DWI regulations provide legally set limits that must be adhered to by water providers. These standards apply at the point of use, i.e. at the tap. It's the responsibility of the Local Authority – **not the Environment Agency** – to ensure that these standards are met.

Our sampling isn't related to any sampling that the Environmental Health Department of your Local Authority may already do at your point of use (e.g. the kitchen tap), and it won't replace this monitoring.

It's possible that our results differ from the Local Authority's because we sample from a different point. We are interested in the quality of the groundwater prior to any treatment or storage, and not what is supplied at the point of use (e.g. household tap) as drinking water.

If you are worried about the quality of your groundwater supply for human consumption and your local council does not already test it, you should contact them directly. They may test the water for a number of parameters, including bacteria. They will advise you on whether the water is suitable for drinking water and if any treatment may be needed.

Units

The data reported in this document is given in the following units:

1 µg/L (or ug) = 1 microgram per litre = 1 millionth of a gram per litre of water sample

1 mg/L = 1 milligram per litre = 1 thousandth of a gram per litre of water sample

Electrical conductivity in **µS/cm** = micro-siemens per centimetre

Temperature = **°C** = degrees centigrade

pH unitless

Some commonly used terms

Aquifer - An aquifer is made up of rocks or soil that can store water in pore spaces and are permeable enough to allow a significant quantity of the water to flow readily into a well, borehole or to a spring line.

Bind to soil – We talk about chemicals binding to soil when we are describing how a chemical can 'stick' to soil particles. Chemicals will bind to soil by a chemical reaction or by electrostatic forces. If a chemical is easily bound to soil then groundwater is more protected as less of the chemical should leach into the groundwater in the rock beneath the soil.

Bio-accumulate or build-up – A chemical will bio-accumulate or build up in a plant or an animal when the plant or animal is exposed to the chemical at a greater rate than its respiratory or digestive system can remove them. Some chemicals can remain in plants or animals for many years. Predatory animals, which eat many prey in their lifetime, will accumulate chemicals from their food and can bio-accumulate high levels of chemicals in their bloodstream.

Break-down or decompose – A substance is broken-down or decomposes when it undergoes natural chemical processes in the soil or groundwater to form simpler chemical substances.

Earth's crust – This is the outermost layer of rocks making up the solid Earth. The Earth's crust is exploited by man for various metal ores, minerals, stone, sand, clay, oil, coal and gas to be used for industry, energy supply, agriculture, manufacturing and construction.

Evaporate – When a chemical evaporates it changes from liquid into a gas. Where a chemical is mixed with water, particularly a river, stream or wetland (i.e. surface water), some of the

chemical may change into a gas and enter the air. The amount of the chemical mixed with the water will then decrease.

Food chain – A food chain is a simple way to describe the relationship of organisms that feed on each other. We put animals into a food chain to identify where they get their energy from so we can identify disruptions to the food chain. For instance a pesticide or herbicide may build up in one type of insect in the food chain. If an animal higher up the food chain eats these insects they will then have consumed a high concentration of this pesticide which may be toxic to them.

Groundwater - Groundwater is water stored in the pore spaces of rock and soil, i.e. the spaces between grains in rock, or between soil particles, or in fractures, fissures or even caves. Groundwater will eventually flow towards the surface or the coast, and adds to flow of water in rivers and wetlands. It's naturally cleaner than river or lake water, although if polluted it's very expensive and takes a long time to clean up. Groundwater is abstracted or pumped out from the aquifer from boreholes or wells, or issues naturally from the ground at springs, or seeps into riverbeds and wetlands.

Half-life – The half-life of a substance is the time taken for half of any given amount of that substance to break-down or decompose into simpler chemicals (break down products). We can use the half-life of a substance to calculate how long it will remain in the environment.

Leach to groundwater – Leaching of chemicals into groundwater describes how substances applied to or entering the soil surface that don't bind to the soil, or aren't taken up by plants, are washed away in rainwater or irrigation water. The water carrying these dissolved chemicals seeps out of the bottom of the soil layer into the rock underneath and then into the groundwater held in the rock aquifer.

Microbial action – Microbes (mainly bacteria) that live in soil and water use substances in the soil or as a food or to respire. When microbes use the chemicals they break them down into simpler substances. This process of breaking down chemicals into simpler, often less harmful chemicals, is called microbial action.

Organic – In this document an 'organic' substance or chemical means a chemical compound which is mainly made up of carbon and hydrogen, with additional nitrogen, oxygen, halogens, phosphorus, silicon or sulphur. Organic or multi-carbon chemicals have a huge range of uses, forming the basis of many man-made products including paints, plastics, food, explosives, drugs, insecticides, pesticides and petrochemicals. More importantly, they provide the basis for life processes, which is why they are referred to as 'organic'. The use of the word 'organic' to describe chemicals containing carbon and hydrogen existed for many years before being used to describe organic farming.

Recharge – Water from rainfall or snow melt, from leaking pipes or sewers buried underground, from rivers during dry periods and from trickle irrigation infiltrates the ground surface. Some of this water is taken up by plants or evaporates from the soil. The remaining water percolates down into the underlying rock and will eventually reach the water table. This water is called recharge as it refills the store of groundwater.

Residual herbicide – A herbicide which isn't broken down easily by microbial action in soil or that doesn't bind to soil very well is called a residual herbicide. These herbicides can remain in the soil for longer than the crop they were used to treat. They can cause problems when planting subsequent crops in the same soil.

Run-off – Once rainfall hits the ground surface of soil or rock, it either seeps into the ground or flows over the surface as 'run-off'. This run-off water is extremely important for replenishing rivers, lakes and wetlands. Where the rainwater comes into contact with and dissolves chemicals which have been applied to the land surface, it will carry these chemicals into the rivers or lakes that it ends up in.

The Chemicals

Use the links below to navigate to different sections.

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A

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Acenaphthene (see PAHs for full description).

UK DWS 0.001 µg/L

Aldrin and Dieldrin

Aldrin and Dieldrin are highly effective insecticides for soil-dwelling pests, and were used to protect wooden structures against termites and wood borers. Dieldrin has also been used against insects which pose a risk to public health. The use of Aldrin and Dieldrin has been severely restricted or banned in many parts of the world since the early 1970s, but they are still used in some countries to control termites. Aldrin is rapidly converted to Dieldrin under most environmental conditions and in humans. Dieldrin can get into water as run-off from treated land. It's a highly persistent organochlorine compound that isn't carried through soil very quickly and builds up in the food chain. It is very toxic to fish and wildlife.

UK DWS 0.03 µg/L

Alkalinity

Alkalinity is a measure of the buffering capacity of water, that is how effective the water is at neutralising acidity. Measuring alkalinity shows us the ability of water to resist changes in pH. Waters with low alkalinity are very susceptible to changes in pH (e.g. from acidic rainfall or pollution). Waters with high alkalinity are able to resist major shifts in pH. Alkalinity helps to regulate the pH of a water body, and also regulate the metal content.

Aluminium

Aluminium has many industrial and domestic uses. Its compounds are used as antacids, antiperspirants and food additives; and aluminium salts are also widely used in treating water. Aluminium occurs naturally in groundwater, especially where the pH of the water is low (i.e. the water is acidic). Low pH in soils of areas with conifer forests can help to release aluminium from clay minerals, which then leaches into groundwater.

UK DWS 200 µg/L

Range in untreated UK groundwater <0.02 to 3980 mg/L

Ammonia and ammonium salts

Ammonia (NH₃) is used in producing fertiliser and animal feed and in manufacturing fibres, plastics, explosives, paper, and rubber. Ammonia and ammonium salts are used in cleansing agents and as food additives, and ammonium chloride is used as a diuretic.

Ammonia may reach groundwater as a result of sewage treatment plant effluent, products from soak-aways, leaking sewers, or from the break-down of naturally occurring organic matter. Vehicle exhaust fumes containing nitrogen dioxide can also produce ammonia, which can leach into groundwater. When ammonia is dissolved in water it changes slightly, gaining a hydrogen ion, to become ammonium (NH₄⁺). We report the ammonium concentration from groundwater samples as the concentration of nitrogen derived from the ammonium ions in the sample, or mg N/L. Other analyses (e.g. by Local Environmental Health departments) may report the concentration of ammonium in a sample i.e. (mg/L NH₄⁺). You can convert between the two ways of measuring this compound by substituting the values you have into the following formulas:

$$1) \text{NH}_4^+ (\text{mg/L}) \times \frac{14}{18} = \text{N} (\text{mg/L}) \text{ to convert ammonium to nitrogen from ammonium}$$

$$2) \text{N} (\text{mg/L}) \times \frac{18}{14} = \text{NH}_4^+ (\text{mg/L}) \text{ to convert nitrogen from ammonium to ammonium}$$

UK DWS 0.5 mg/L NH₄ or 0.3 mg/L of N

Range in untreated UK groundwater <0.0004 to 52 mg/L

Anthracene (see PAHs for full description).

Antimony

Antimony is a metal used in batteries, ammunition, cable sheathing, flame-proofing compounds, ceramics, glass, pottery and fireworks. Some antimony compounds are used for treating parasitic diseases and as pesticides.

Antimony can enter the aquatic environment through natural weathering of rocks, runoff from soils, effluents from mining and manufacturing operations, and industrial and municipal leachate discharges. Soft water may leach antimony from household pipes, causing it to be present in tap water.

UK DWS 5 µg/L

Range in untreated UK groundwater <0.0029 to 3.01 µg/L

Arsenic

Arsenic compounds are used commercially and industrially in the manufacture of lasers, and the processing of glass, pigments, textiles, paper, metal adhesives, wood preservatives, and ammunition. They are also used, within limits, as pesticides, feed additives, and pharmaceuticals. Arsenic may occur naturally in groundwater where the aquifer is made of rock containing metal sulphides such as pyrite (fool's gold). When these minerals 'rust' after being exposed to oxygen, the rust products are dissolved in groundwater and produce acid. This lowers the pH of groundwater making it easier for metals like arsenic to stay dissolved, and also encouraging the weathering of the rock. Sandstone and shale aquifers tend to have a high metal sulphide content.

UK DWS 10 µg/L

Range in untreated UK groundwater <0.02 to 354.6 µg/L

Asulam (Asulox)

Asulam is a selective post-emergent systemic carbamate herbicide used to control a variety of annual grasses and broad-leaved weeds. Although asulam is of relatively low toxicity, the USEPA classified it as a carcinogen in humans.

Asulam is highly mobile and has a strong potential to leach into ground water or move offsite into surface water.

General UK DWS for pesticides 0.1 µg/L

Atrazine, Atrazine-Desethyl and Atrazine-Desisopropyl

Atrazine is used as a selective herbicide to control weeds in asparagus, maize, sorghum, sugar-cane, and pineapple. It's also used in forestry and for non-selective weed control on non-crop areas. Several countries have restricted its use, and in the UK it will be banned from July 2007 (WHO).

Microbial activity and other chemicals may breakdown atrazine in soil and water, particularly in alkaline conditions. It may bind to some soils, but generally tends to leach to groundwater (USEPA).

Atrazine UK DWS 0.1 µg/L

Range in untreated UK groundwater <0.0008 to 45.9 µg/L

Atrazine Desethyl UK DWS 0.1 µg/L

Atrazine Desisopropyl UK DWS 0.1 µg/L

Azinphos-Ethyl and Azinphos-Methyl

Azinphos-ethyl is used as an insecticide for a broad range of insects, including beetles and their larvae, aphids, jassids and spider mites, on various crops such as cotton, rice, sugar and fodder beets, apples, pears, citrus-fruit, grapes and tobacco. (USEPA)

UK DWS 0.1 µg/L for both chemicals

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Barium

Barium compounds are used in the plastics, rubber, electronics, and textiles industries, in ceramic glazes and enamels, in glass-making, brick-making, and paper-making, in pharmaceuticals and cosmetics, and in the oil and gas industry.

Barium doesn't bind to soil and so may travel to groundwater, but it has a low tendency to accumulate in aquatic life (USEPA). Barium may also occur naturally in groundwater, particularly where the aquifer is made of limestone or chalk.

USEPA guideline value 2 mg/L

Range in untreated UK groundwater <0.06 to 2967.57 µg/L

Benazolin

Benazolin is a herbicide used to control many annual broad-leaved weeds, particularly black bindweed, common chickweed, cleavers and charlock in oilseed rape. It's used in combination with other herbicides to control a wider range of broad-leaved weeds in oilseed rape, cereals, grassland, clover, alfalfa and flax. Benazolin can enter water as run-off from treated land.

General UK DWS for pesticides 0.1 µg/L

Bendiocarb

Bendiocarbamate is used to control mosquitoes, flies, wasps, ants, fleas, cockroaches, silverfish, ticks, and other pests in homes, industrial plants, and food storage sites. In agriculture, it's used especially against insects that live in the soil. Bendiocarb is also used as a seed treatment on sugar beets and maize and against snails and slugs. It can remain in the soil for a few days before being broken down, though it's unlikely to leach to groundwater.

General UK DWS for pesticides 0.1 µg/L

Bentazone

Bentazone is a contact herbicide used in winter and spring cereals, maize, peas, rice, and soybeans. It's very mobile in soil and moderately persistent in the environment, but it is broken down by sunlight in soil and water. Bentazone has been reported to occur in surface water, groundwater and drinking-water at concentrations of a few micrograms per litre or less. Although it has been found in groundwater, it doesn't seem to build up in the environment.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.05 to 8.9 µg/L

Benzene

Benzene is used in the chemical industry, for making plastics, rubber, nylon, and polyester, and as an additive in petrol. Other uses include as a solvent in printing, paints, paint thinner, dry cleaning, etc. It can get into the atmosphere through vehicle emissions, and into water through discharges of industrial effluent, and from spills and leakages from storage tanks. Some will evaporate if it's released to soil. It is highly mobile and can leach into groundwater, although it will be broken down over time.

UK DWS 1 µg/L

Range in untreated UK groundwater

Typical values outside UK 0.03-0.3 mg/L at contaminated point sources

Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene
(see PAHs for full description).

UK DWS for total PAHs 0.1 µg/L

Benzo(a)pyrene (see PAHs for full description).

UK DWS 0.01 µg/L

Beryllium

Beryllium occurs naturally in the environment, and is also released through mining operations. It's used for space vehicles, X-ray equipment, and electrical components. It's mainly released into the atmosphere by the smoke and ash wastes from coal-burning power stations.

Very little is known about what happens to beryllium compounds when they are released to the environment. It appears unlikely to leach to ground water when released to land.

USEPA guideline value 0.004 mg/L

Range in untreated UK groundwater <0.0004 to 4 µg/L

Boron

Boron occurs naturally in over 80 different minerals and rocks and forms 0.001% of the Earth's crust. It can also get into the environment through industrial activities. Ocean water contains boric acid, and the evaporation of seawater from closed basins provides a commercial source of boron.

It's used in composite structural materials, high-temperature abrasives, steel-making, catalysts, jet and rocket fuel and in controlling heavy metals in waste water discharges. In the past, boric acid, borates, and perborates have been used as mild antiseptics or in eyewashes, mouthwashes, burn dressings, and nappy rash powders. Borax is used extensively as a cleaning compound, and borates are applied as agricultural fertilisers. Boron compounds are also used as algicides, herbicides, and insecticides.

UK DWS 1 mg/L

Range in untreated UK groundwater <0.07 to 3442 µg/L (expected to increase at coast)

Bromate

Sodium and potassium bromate powerful oxidisers and are mainly used in permanent wave solutions for hair treatment and for dyeing textiles. Potassium bromate is also used as an oxidiser to mature flour during milling, in treating barley in beer making and in fish paste products. Bromate may be formed when hypochlorite solutions are used to treat drinking water, but it's not normally found in untreated groundwater.

UK DWS 10 µg/L BrO₃

Range in untreated UK groundwater <0.0002 to 19.8 mg/L

Bromide

Bromide ions occur naturally in surface water and groundwater. Bromide concentrations in groundwater can fluctuate with the season, but are also affected by saltwater intrusion to an aquifer or pollution.

Range in untreated UK groundwater <0.007 to 36.5 mg /L

Bromodichloromethane (see Trihalomethanes)

Bromodichloromethane occurs naturally in very small quantities. It is a by-product of the chlorination process used to treat drinking water and is also used to make other chemicals and as a solvent. It will evaporate if it's released to soil. This substance can leach into groundwater.

UK DWS 100 µg /L

Bromoform (see Trihalomethanes)

Bromoform is used in making pharmaceuticals, as a solvent and in the aircraft and shipbuilding industries. It's also forms as a by-product in chlorinated drinking water. Bromoform is released into the environment through industrial activities, and it can leach from soil into groundwater.

UK DWS 100 µg/L

Bromoxynil

Bromoxynil is a contact herbicide used to control of broad-leaved weeds in grain crops. It persists in soils for 3 to 12 months. Bromoxynil was ranked high with respect to potential for groundwater contamination in an Agriculture Canada survey.

Canadian EPA guideline value 0.005 mg/L

Bupirimate

An organophosphate pesticide mainly used as a fungicide. It can enter water as run –off from treated land.

General UK DWS for pesticides 0.1 µg/L

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Cadmium

Cadmium metal is used mainly as an anti-corrosive layer on steel. Cadmium sulphide and selenide are used as pigments in plastics. Cadmium compounds are used in electric batteries, electronic components, and nuclear reactors. Major industrial releases of cadmium are due to waste streams and leaching of landfills. Cadmium can also reach drinking water as a result of the materials used in main water pipes being corroded.

UK DWS 5 µg/L

Range in untreated UK groundwater <0.0007 to 42 µg/L

Calcium (see Total Hardness)

Calcium enters the freshwater system through the weathering of rocks, especially limestone, and from the soil through seepage, leaching and runoff. Acid rain causes increasing amounts of calcium to leach from the soil. Calcium oxide (lime) is used extensively in mortar, stucco and plaster in the building industry. It's used in pulp and paper production, sugar refining, petroleum refining and tanning. Lime is also widely used as a wastewater treatment chemical.

Range in untreated UK groundwater <0.484 to 795 mg/L

Carbendazim

Carbendazim is a systemic fungicide used to control plant disease on arable crops (cereals, oilseed rape), fruits, vegetables and ornamentals. It's also used in post-harvest food storage, and as a seed pre-planting treatment. It's frequently sold in combination with other fungicides, such as triazoles, dithiocarbamates and dicarboximides. Carbendazim works by stopping the fungi developing. It can get into water as run-off from treated land.

General UK DWS for pesticides 0.1 µg/L

Carbetamide

A residual herbicide which can get into groundwater as a result of agricultural use or poor storage.

General UK DWS for pesticides 0.1 µg/L

Carbon dioxide (dissolved gas)

Almost all natural waters contain some carbon dioxide. Falling rain absorbs some of the carbon dioxide gas (CO₂) present in the air, and becomes slightly acid. On reaching the earth, the rainwater absorbs more carbon dioxide if it flows through decaying vegetation. At the same time, the carbon dioxide becomes carbonic acid. If the water now passes through limestone formations, its carbonic acid content will react with the limestone to form soluble calcium bicarbonate. In this process the carbonic acid is partially neutralised. If the rainwater passes through rock formations such as granite, no reaction occurs. Carbonic acid isn't neutralised. It continues as carbonic acid until drawn to the surface, where it can be corrosive. If carbonic acid isn't neutralised it will corrode both copper and galvanised plumbing systems. It can seriously damage plumbing equipment. Carbon dioxide, together with carbonic acid, is mainly a problem in water with relatively low concentrations of minerals as there aren't enough alkaline salts to buffer the effect of the carbonic acid.

Carbon tetrachloride (Tetrachloromethane)

Carbon tetrachloride was used mainly in the production of chlorofluorocarbon refrigerants, foam-blowing agents, and solvents. It was also used in the manufacture of paints and plastics, and as a solvent in metal cleaning.

It's released to the environment through landfills, agricultural activities and waste water from industry. It quickly evaporates from surface water, though may leach to groundwater from soil. It's unlikely to build up in aquatic life. At one time it was the main constituent of household dry-cleaning fluids and of fire extinguishers used with electrical and petrol fires. Its use became restricted after it was discovered to be carcinogenic and it has now been largely removed from educational and industrial laboratories.

UK DWS 3 µg/L

Range in untreated UK groundwater <0.01 to 600 µg/L

Carbophenothion

An organophosphorous insecticide used to treat wheat seed, citrus fruit, sorghum and other vegetables. It can remain in the soil for 6 months or longer.

General UK DWS for pesticides 0.1 µg/L

Carboxylic acid herbicides (including clopyralid)

The carboxylic acid herbicides include pichloram, triclopyr, fluoroxypr, clopyralid and quinclorac. These are used to control perennial broadleaf weeds and brush. Pichloram will remain in soil for some time whereas triclopyr and clopyralid are less persistent. The herbicide **clopyralid** is used to kill unwanted plants in lawn and turf, pasture, rights-of-way, sugarbeets, mint and wheat. Clopyralid may leach into groundwater as it's highly soluble in water and doesn't easily decompose in some soils. Groundwater may be contaminated if clopyralid is applied to areas where soils are very permeable and the water table is shallow. Clopyralid can also contaminate groundwater if it's applied to soils containing sinkholes or severely fractured surfaces.

General UK DWS for pesticides 0.1 µg/L

Chlordane cis and Chlordane trans

Chlordane is a versatile insecticide used to protect structures, and used on lawn and turf, ornamental trees, and drainage ditches. It's also used on corn, potatoes, and livestock. It's injected into the soil surface to control termites. Recently, chlordane use has been increasingly restricted in many countries. Chlordane may be a low-level source of contamination of groundwater when injected into the soil. It is very resistant to breakdown, and is highly immobile in soil. As a result it's unlikely to migrate to groundwater, where it has only rarely been found.

UK DWS 0.1 µg/L

Typical values outside UK <0.1 µg/L

Chlorfenvinphos

Chlorfenvinphos is a man-made chemical used as an insecticide. Chlorfenvinphos can be toxic to wildlife and enters the environment through its use on crops and soil as an agricultural insecticide. There are no natural sources of the substance (UK EA). Chlorfenvinphos also enters the environment from runoff after rainfall and leaching from hazardous waste sites, and it may leach into soil and groundwater. Chlorfenvinphos doesn't appear to accumulate in plants, fish, or freshwater animals.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.001 to 0.015 µg/L

Chloridazon

A residual herbicide for beet crops (swede and beet). It gets into water as a result of agricultural activities.

General UK DWS for pesticides 0.1 µg/L

Chloride

Sodium chloride (table salt) is present in rainwater, and is widely used in the production of industrial chemicals such as caustic soda, and chlorine. Sodium chloride, calcium chloride, and magnesium chloride are extensively used in snow and ice control. Potassium chloride is used in the production of fertilisers. Chloride may be found in groundwater as a result of saltwater intrusion, and concentrations tend to increase closer to the coast.

UK DWS 250 mg/L

Range in untreated UK groundwater <0.5 to 28100 mg/L

Chlormequat

Chlormequat chloride is used to regulate plant growth in azaleas, poinsettias, geraniums, and hibiscus or for cotton, various vegetables, grape vines, mango, tobacco, and ornamentals. It can get into water as a result of agricultural activities.

UK DWS 0.1 µg/L

Range in untreated UK groundwater <0.05 to 39 µg/L

Chloroform (see Trihalomethanes)

UK DWS 100 µg/L

Range in untreated UK groundwater <0.01 to 517 µg/L

Chlorophenols (including 4-Chloro-3-methylphenol)

Chlorophenols are present in drinking-water as a by-product of treatment with chlorine.

WHO guideline value 0.1 µg/L

Chlorophenoxy herbicides (Chlorophenol-3 and Chlorophenol-4, also see 2,4 D, 2,4 DB and 2,4,5 T (Fenoprop))

Chlorophenoxy herbicides are used throughout the world to control weeds in a variety of agricultural crops. They are also used non-agricultural areas to control brush vegetation. They are also used to control some aquatic weeds, and as a pre-harvest treatment to reduce early drop in apple orchards.

General UK DWS for pesticides 0.1 µg/L

Chlorothalonil

Chlorothalonil is used as a fungicide and is almost insoluble in water. It can be found in groundwater which is vulnerable to contamination due to lack of protection from thin soils or where water rapidly percolates down to the water table.

General UK DWS for pesticides 0.1 µg/L

Chlortoluron

Chlortoluron is a herbicide that is slowly biodegradable and mobile in soil. It can get into the environment through agricultural activities – leaks, spills and being disposed of incorrectly.

General UK DWS for pesticides 0.1 µg/L

Chloroxuron

Chloroxuron is a residual herbicide for strawberries and ornamentals, and is available commercially as soluble powders.

General UK DWS for pesticides 0.1 µg/L

Chlorpyrifos-ethyl and Chlorpyrifos-methyl

Chlorpyrifos is an organophosphorus insecticide used to control mosquitoes, flies, various crop pests, household pests and aquatic larvae. It's also used on sheep and cattle to control ectoparasites. Chlorpyrifos remains in the soil for 60 to 120 days, and is broken down by microbial action (Canadian EPA).

General UK DWS for pesticides 0.1 µg/L

Chromium

Chromium and its salts are used in the leather tanning industry, the manufacture of pigments and paints, fungicides, the ceramic and glass industry, and in photography. It's also used for chrome alloy and chromium metal production, chrome plating, and to control corrosion. It gets into the environment through leakages, poor storage and bad disposal practices.

UK DWS 50 µg/L

Range in untreated UK groundwater <0.0004 to 386.16 µg/L

Chrysene (see PAHs for full description)

UK DWS 0.01 µg/L

Cobalt

Cobalt is a metal that may be stable (non-radioactive, as found in nature), or unstable (radioactive, man-made). Non-radioactive cobalt occurs naturally in various minerals, and has been used for thousands of years to give a blue colour to ceramic and glass. The radionuclide, cobalt-60, is produced as a by-product of nuclear reactor operations.

Conductivity (SEC)

Conductivity is a measure of the ability of a fluid to carry an electrical charge. This ability is directly related to the concentration of dissolved substances. The greater the total dissolved substances in the water, the greater the conductivity of the water. The units of measure are in micro-siemens per cm of water ($\mu\text{S}/\text{cm}$).

UK DWS 2500 $\mu\text{S}/\text{cm}$ @25 degrees C

Range in untreated UK groundwater 7 to 9550 $\mu\text{S}/\text{cm}$

Copper

Copper occurs naturally in the environment. It's an important heat and electrical conductor and is used for water pipes, roof coverings, household goods, chemical equipment, and in many alloys (e.g. brass and bronze). Copper compounds are widely used in pest control, as inorganic dyes, as feed additives, in seed disinfectants, as fungicides and algicides. It can get into drinking water through corroded copper pipes, with high levels occurring as a result of industrial waste.

UK DWS 2 mg/L

Range in untreated UK groundwater <0.0037 to 1261.1 $\mu\text{g}/\text{L}$

Coumaphos

Coumaphos is an organophosphate pesticide used to treat lice, fleas and other livestock insect pests. It's also used in water to control mosquito larvae. It binds well to soil so is unlikely to leach to groundwater.

General UK DWS for pesticides 0.1 $\mu\text{g}/\text{L}$

Cresol-m, Cresol-o and Cresol-p

Cresols do occur naturally and can also be man-made. They are used as disinfectants, preservatives, and wood preservatives. Cresol-o is used as a solvent, disinfectant, and chemical intermediate. Cresol-m is used to produce certain herbicides, antioxidants, and to manufacture the explosives. Cresol-p is used to make antioxidants and in the fragrance and dye industries.

Cresols get into the environment through natural sources (present in wood and tobacco smoke) and don't bind well to soil. This means they can move into groundwater, where they can remain for some time unless bacteria are present to break them down. Cresols won't build up in aquatic organisms.

Range in untreated UK groundwater Cresol-o <0.04 to 0.12 $\mu\text{g}/\text{L}$

Cyanazine

Cyanazine is a herbicide used to control annual grasses and broad-leaved weeds in corn, cotton, grain sorghum and wheat fallow. Cyanazine has a low to moderate persistence in soil and it's quickly broken down by microbes and bacteria.

General UK DWS for pesticides 0.1 $\mu\text{g}/\text{L}$

Cyanide

The most commonly used form of cyanide, hydrogen cyanide, is used in making nylon and other synthetic fibres. Other cyanides are used as herbicides. The major cyanide releases to water are discharges from metal finishing industries, iron and steel mills, and organic chemical industries. Releases to soil are mainly from cyanide wastes in landfills and the use of cyanide-containing road salts. Cyanides don't generally remain in water or soil as they quickly evaporate and are broken down by microbes. They don't generally build up in aquatic organisms.

UK DWS 50 $\mu\text{g}/\text{L}$

Range in untreated UK groundwater <0.003 to 0.3 mg/L

Cypermethrin

Cypermethrin is an insecticide used on wheat, barley and oilseed rape, and as a sheep dip. It can remain in the soil for a while, although it breaks down more rapidly on sandy clay than on clay soils.

General UK DWS for pesticides 0.1 $\mu\text{g}/\text{L}$

2,4-D (2,4-dichlorophenoxy acetic acid) [Back to index](#)

2,4-D is a herbicide widely used throughout the world to control of broadleaved weeds in cereal cropland and on lawns, turf and pastures. It's also used to control aquatic weeds. In soils and water it's quickly broken down by microbes. It leaches easily to ground water especially from coarse-grained, sandy soils with low organic content.

General UK DWS for pesticides 0.1 µg/L

2,4 DB (4 Butyric acid)

2,4 DB is a herbicide used for the control of many annual and perennial broad-leaved weeds. 2,4 DB breaks down into 2,4 D by microbial action, and will leach to groundwater.

General UK DWS for pesticides 0.1 µg/L

D

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DDE OP (Dichlorodiphenylethylene), DDE PP, DDT OP and DDT PP

DDE OP and DDE PP are break down products of DDT or Dichloro-Diphenyl-Trichloroethane. DDT is an insecticide with a broad range of uses. It was banned in several countries in the early 1970s due to its devastating effect on wildlife.

Its use has now been restricted or banned world-wide except when it's needed to protect human health. DDT is still used to control yellow fever, sleeping sickness, typhus, malaria, and other insect-transmitted diseases. DDT will remain in the environment for a long time, and can leach into groundwater over many years.

UK DWS value for DDEPP, DDE OP, DDT PP and DDT OP 0.1 µg/L

Typical global value for DDT OP <1 µg/L in Surface waters

Desmetryn

This selective herbicide is used to control broadleaf and grassy weeds, typically used on herbs, onions, leeks and conifer seedbeds. Desmetryn tends to be absorbed from water into sediments.

General UK DWS for pesticides 0.1 µg/L

Diazinon

Diazinon is an organophosphorus insecticide used to control soil and household insect pests, as well as insects and mites on a wide variety of crops. It's also used to control parasites on animals. Diazinon quickly breaks down in the soil.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.001 to 0.14 µg/L

Dibenzo(ah)perylene (see PAHs)

UK DWS 0.001 µg/L

Dibromochloromethane (see Trihalomethanes THMs)

UK DWS total THMs 100 µg/L

Range in untreated UK groundwater <0.1 to 5.3 µg/L

Dicamba

Dicamba is a herbicide that controls annual and perennial broadleaf weeds in grain crops and grasslands, and controls brush and bracken in pastures. Dicamba is used in combination with other herbicides in pastures and non-crop areas (fences, roads and wastage) to control weeds. It doesn't bind to soil particles and is highly soluble in water, so may contaminate groundwater.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.04 µg/L

Dichlobenil

Dichlobenil is used to control all kinds of weeds, including annual and perennial grasses and broad-leaved weeds and aquatic plants. Dichlobenil doesn't dissolve easily in water. The USEPA has concluded dichlobenil has the potential for reaching groundwater based on its chemical structure, water solubility, and patterns of use.

General UK DWS for pesticides 0.1 µg/L

1,1 Dichloroethane and 1,2 Dichloroethane

1,1-Dichloroethane is a man-made liquid, used in the production of 1,1,1-Trichloroethane, vinyl chloride, and other chemicals. It's also used as a solvent in paint and varnish removers, as a degreaser and cleaning agent. It was formerly used as an anaesthetic. It's released into the environment as a result of industrial processes. If 1,1-Dichloroethane is released to soil or water it will evaporate into the air. The vapour in the air is then broken down by sunlight.

1,2-Dichloroethane is used in producing vinyl chloride, as a solvent and in leaded petrol. It's also used to make other chemicals needed to produce plastics, rubber and synthetic textiles. It enters the environment as a result of industrial activities. It can leach rapidly from soil into groundwater and remain there for a very long time.

Typical values outside UK

Dichloroethane-1,1 10 µg/L to 400 µg/L (USA groundwater value).

Dichloroethane-1,2 6-61 µg/L (USA & Europe)

1,1-Dichloroethene, 1,2-Dichloroethene (cis) and 1,2-Dichloroethene (trans)

1,1-Dichloroethene (1,1 DCE) is an organic liquid with a mild, sweet, chloroform-like odour. It is mainly used in making adhesives, synthetic fibres, refrigerants and food packaging. It evaporates when released to water. It will also evaporate from soil and will leach into the groundwater. It's uncertain what happens to 1,1 DCE once it's in groundwater, although it's unlikely to build up in aquatic organisms.

1,2-Dichloroethene (1,2-DCE) is an odourless organic liquid that has two slightly different forms, a "cis" form and a "trans" form. A mixture of both forms is used as a solvent for waxes and resins, in the extraction of rubber, as a refrigerant, in the manufacture of pharmaceuticals and artificial pearls and in the extraction of oils and fats from fish and meat.

1,2 DCE gets into water through spills, leakages or incorrect disposal. It will quickly evaporate if it's released to surface water or soil, but if it enters groundwater it can remain there for a very long time without decomposing.

1,1-Dichloroethene USEPA value 7 µg/L

Typical value outside UK 0.28-1.2 µg/L in USA groundwater

1,2-Dichloroethene cis <0.1 to 84.6 µg/L

1,2-Dichloroethene trans <0.1 to 12 µg/L

Dichlorophenol (see Chlorophenols)

WHO guideline value 0.1 µg/L

Dichlorophenol-2,5 (see Chlorophenols)

Dichlorophenol-2,6 (see Chlorophenols)

Dichlorprop (2,4-DP) (see Chlorophenoxy herbicides)

WHO guideline value 100 µg/L

Dichlorvos

Dichlorvos is used to control insects in food storage areas and to control insects on livestock. It's not generally used on outdoor crops. Vets use it to control parasites on pets. It doesn't bind well to soil so can leach into groundwater. It will break down quicker in alkaline soils and waters.

General UK DWS for pesticides 0.1 µg/L

Dieldrin (see Aldrin)

UK DWS 0.03 µg/L

Diflurobenzuron

Diflurobenzuron is an insecticide normally applied directly to plants or water. Its rapidly adsorbed to soil and particles and is immobile in soil. It will also rapidly adsorb to sediments and the sides of vessels and pipes. In soils over 90% is degraded and in alkaline water it is rapidly hydrolysed.

General UK DWS for pesticides 0.1 µg/L

Dimethoate

Dimethoate is an organophosphorus insecticide used to control houseflies, as well as a wide range of insects and mites on a variety of fruit, vegetable, field and forestry crops. Dimethoate will leach from the soil into groundwater if it's released to the environment.

General UK DWS for pesticides 0.1 µg/L

DO (Dissolved Oxygen)

The amount of dissolved oxygen present in water depends on the water's physical and chemical characteristics (particularly temperature and salinity). Dissolved oxygen is measured in mg/l or in % saturation.

Range in untreated UK groundwater 0.1 to 14.7 mg/L

Typical Values In fresh water at 5, 10, and 20°C, the saturation concentrations are 12.8, 11.3, and 9.1 mg/L, respectively

Diuron

Diuron is a herbicide used to control vegetation in non-crop areas, including irrigation and drainage ditches. It can remain in soils for a full season or longer, and the USEPA has ranked it as having a fairly high potential to contaminate groundwater.

Range in untreated UK groundwater <0.005 to 4.8 µg/L

E

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Endosulphan I and Endosulphan II

Endosulphan is an insecticide used throughout the world to control pests on fruit, vegetables and tea and on non-food crops such as tobacco and cotton. It's also used to control the tsetse fly, as a wood preservative and for the control of home garden pests.

Endosulphan contamination doesn't appear to be widespread in the aquatic environment, but the chemical has been found in agricultural runoff and rivers in industrialised areas where it's manufactured, as well as in surface water and groundwater samples collected from hazardous waste sites in the USA.

General UK DWS for pesticides 0.1 µg/L

Endrin (see also Aldrin and Dieldrin)

Endrin is an organochlorine insecticide that has been used mainly on field crops such as cotton, maize, sugarcane, rice, cereals, ornamentals, and other crops. It has also been used to control grasshoppers in non-cropland and voles and mice in orchards. It's use was stopped in 1980. Traces of Endrin have been found in the drinking-water supplies of several countries.

UK DWS 0.03 µg/L

Ethion

The main use of Ethion is to control insects on citrus trees. It's also used on cotton, fruit and nut trees, a variety of vegetables and on lawns and turf grasses.

Ethion can react with water and be broken down. Laboratory testing shows that the less acidic the water is, the more rapidly Ethion is broken down into harmless substances.

General UK DWS for pesticides 0.1 µg/L

Ethofumesate

Ethofumesate is a herbicide used on sugarbeets, fodderbeets, beans, peas, red beets and tobacco. It can leach to groundwater as a result of agricultural activities.

General UK DWS for pesticides 0.1 µg/L

Ethyl benzene

Ethyl benzene is used with other chemicals (xylenes) in the paint industry, in insecticide sprays, and in petrol blends. It evaporates rapidly from water, and will be degraded by microbes. It may leach to groundwater if released to land, but won't build up in aquatic life.

WHO guideline value 300 µg/L

Typical Value 0.07 µg/L in UK groundwater

Ethyl Tertiary Butyl Ether (ETBE)

ETBE is usually blended with petrol to increase the cleanliness of combustion in engines and improve air quality.

F

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Fenclorophos

An organophosphorous insecticide used to treat ectoparasites on cattle and other livestock, and in fly control on farms. It can get into the environment as a result of agricultural activities.

General UK DWS for pesticides 0.1 µg/L

Fenitrothion

Fenitrothion is mainly used in agriculture for controlling insects on rice, cereals, fruits, vegetables, stored grains and cotton and in forest areas. It's also used to control flies, mosquitoes and cockroaches in public health programmes and/or indoor use.

General UK DWS for pesticides 0.1 µg/L

Fenoprop (see 2,4,5 TP)

Fenpropimorph

Fenpropimorph is used as a fungicide mainly on wheat and winter barley. It breaks down more easily in sandy soils with low organic matter content.

General UK DWS for pesticides 0.1 µg/L

Fenthion

Fenthion is used as a highly persistent insecticide. It's effective against fruit flies, leaf hoppers, cereal bugs, weaver birds, animal parasites, mites, aphids, codling moth. It can remain in soil for up to 6 weeks, though it's unlikely to leach into groundwater.

General UK DWS for pesticides 0.1 µg/L

Fenuron

Used as a herbicide to control woody plants and deep rooted perennial weeds, particularly on non cropped land. Often used in combination with chloroprotham to extend the weed spectrum and range of crops. Fenuron is broken down by exposure to light and by microbes.

General UK DWS for pesticides 0.1 µg/L

Flumethrin

Flumethrin is a non-systemic insecticide used as a sheep dip for the control of ticks and lice. It's expected to be rapidly and strongly adsorbed onto soil and sediments and also quite rapidly degraded in soils.

General UK DWS for pesticides 0.1 µg/L

Fluoranthene (see PAHs)

Fluoranthene is the most commonly detected Polynuclear Aromatic Hydrocarbon (PAH) in drinking-water and is associated primarily with coal-tar linings of cast iron or ductile iron distribution pipes.

UK DWS Total PAHs 0.1 µg/L

Range in untreated UK groundwater <0.01 to 0.03 µg/L

Fluorene (see PAHs)

UK DWS Total PAHs 0.1 µg/L

Fluoride

Inorganic fluoride compounds are used to make aluminium and to produce phosphate fertilisers, bricks, tiles, and ceramics. Fluoride may occur naturally in groundwater, particularly in confined chalk aquifers where the groundwater has been in contact with rock for thousands of years.

UK DWS 1.5 mg/L

Range in untreated UK groundwater <0.01 to 81 mg/L

Fluoroxypyr (see Carboxylic acid herbicides)

Fluoroxypyr is a selective herbicide used for controlling woody weeds.

General UK DWS for pesticides 0.1 µg/L

Flutriafol

Flutriafol is an agricultural fungicide and seed treatment to control ear and foliar diseases in winter and spring wheat and barley. It's extremely persistent in soil and will build up over time and repeated annual applications.

General UK DWS for pesticides 0.1 µg/L

Fonofos (Dyfonate)

Fonofos is a soil insecticide in cereals, maize, sorghum, vegetables, ornamentals, fruit (including citrus and bananas), vines, olives, potatoes, sugar beet, sugar cane, groundnuts, tobacco, and turf. Fonofos is also used as soil fumigant and controls corn borers and rootworms, cutworms, symphylans (garden centipedes), wireworms, and other soil/foliar pests. It can't move through soil and is quickly broken down by microbes, so is only rarely detected in groundwater.

General UK DWS for pesticides 0.1 µg/L

H

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HCH α , β and γ (Hexachlorocyclohexane, γ -HCH or Lindane)

Lindane is used as an insecticide on fruit and vegetable crops, for seed treatment and in forestry. It's also used as a dip for fleas and lice on pets and livestock, for soil treatment, on the foliage of fruit and nut trees, vegetables, timber, ornamentals and for wood protection. Several countries have restricted the use of lindane. It can break down in soil and rarely leaches to groundwater. In surface waters it can be removed by evaporation. HCH has been detected in both surface water and groundwater, usually at concentrations below 0.1 mg/litre. Concentrations as high as 12 mg/L have been measured in rivers contaminated by wastewater. When released to water, lindane is not broken down by microbes, but it is attacked by chemicals in alkaline waters. In soil it's broken down by microbes, and may evaporate from the surface, or slowly leach to groundwater. Lindane will accumulate slightly in fish and shellfish.

UK DWS for organochlorine compounds 0.03 µg/L

Heptachlor

Heptachlor is applied as a soil treatment, a seed treatment (maize, small grains, and sorghum), or directly to foliage. It's used to control ants, cutworms, maggots, termites, thrips, weevils, wireworms, and many other insect pests in both cultivated and uncultivated soils. Heptachlor also controls household insects and pests of humans and domestic animals. In many countries, heptachlor is banned or applied only by subsurface injection.

UK DWS for all forms 0.03 µg/L

Hexachlorbenzene

Hexachlorobenzene (HCB) is a selective fungicide used to control dwarf bunt of wheat. In many countries it's no longer produced or used. The main source of this chemical is from the breakdown of other chemicals or as an impurity in some pesticides. HCB will remain in the environment for a long time as it's resistant to microbial breakdown in soil or water. HCB can remain in lake and river sediments and will bio-accumulate in fish.

UK DWS 0.1 µg/L

Hexachlorobutadiene (HCBD)

Hexachlorobutadiene is used as a solvent in chlorine gas production, a lubricant, a gyroscopic fluid, a pesticide, a fumigant in vineyards and an additive in explosives. It gets into the environment through industrial discharges.

UK DWS 0.1 µg/L

Typical values outside UK 0.5-5 µg/L Europe

I

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Indeno(123-cd)pyrene (see PAHs)

UK DWS Total PAHs 0.1 µg/L

Iodide

Iodine occurs naturally in water in the form of iodide. Iodine is occasionally used to disinfect water when in the field or in emergency situations.

Range in untreated UK groundwater <0.00063 to 20.8 mg/L

Iodofenphos

Iodofenphos is an organophosphorus insecticide that is harmless to mammals. It is used to protect stored products and in public health protection. It's mainly used against livestock pests, such as ectoparasites, mosquito larvae, mites, flies and mosquitoes.

General UK DWS for pesticides 0.1 µg/L

loxynil (see Bromoxynil)

Iprodione

Iprodione is a fungicide used to control a wide variety of crop diseases. It's used on vegetables, ornamentals, stone fruit, root crops, cotton, and sunflowers to control fungal pests. It can also be used as a seed treatment. Iprodione works by preventing the germination of spores and the growth of fungal mats. It's moderately soluble in water and can move easily through sandy and loam soils, and so it can potentially leach into groundwater.

General UK DWS for pesticides 0.1 µg/L

Iron

Iron is used for steel drinking-water pipes, and iron oxides are used as pigments in paints and plastics. Other iron compounds are used as food colours and to treat iron deficiency in humans. Various iron salts are used in treating water.

Iron occurs naturally in groundwater, particularly where the aquifer is made of sandstone or other sedimentary rock. It's also present in natural waters due to the weathering of rocks and minerals, acidic mine water drainage, landfill leachates, sewage effluents and iron-related industries.

UK DWS 200 µg/L

Range in untreated UK groundwater <0.005 to 1540000 µg/L

Isodrin

Isodrin is a man-made chemical, formerly used as an insecticide in agriculture and to control disease-spreading insects such as malarial mosquitoes. It's related to Aldrin, Dieldrin and Endrin. This pesticide is now banned in the UK and the rest of the EU. It is still used in some countries, and can escape into the environment during manufacture, transport or storage. Isodrin is highly resistant to decomposition and as a result can remain in the environment for years.

UK DWS for organochlorine compounds 0.03 µg/L

Isoproturon

Isoproturon is a herbicide used to control annual grasses and broad-leaved weeds in cereals. It can remain in the soil for weeks, but will eventually be broken down by exposure to light, water and microbial action.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.005 to 3.9 µg/L

L

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Lead

Lead is used in the production of lead acid batteries, solder, alloys, cable sheathing, pigments, rust inhibitors, ammunition, glazes, and plastic stabilizers. From a drinking-water perspective, the almost universal use of lead compounds is in plumbing fittings and as solder in water-distribution systems. High levels of lead in raw groundwater can come from the lead pipes used in older distribution systems and plumbing.

UK DWS 25 µg/L

Range in untreated UK groundwater <0.007 to 6650 µg/L

Linuron

Linuron is a herbicide used to control broadleaf and grassy weeds on crop and non-crop sites. It's used in soybean, cotton, potato, corn, bean, pea, winter wheat, asparagus, carrot, and fruit crops. It is also used on crops stored in warehouses and storerooms. Linuron is moderately persistent in soils and isn't likely to build up, although if a soil contains a lot of organic matter the chemical is more likely to bind to it. Linuron isn't readily broken down in water and has been found at very low concentrations (2-3 ppb) in well and groundwater in several US states.

General UK DWS for pesticides 0.1 µg/L

Lithium

Lithium occurs naturally in minerals and salts, and is present in limestone and sandstone and associated groundwater. It's used in batteries, some greases, some glasses, and in medicine. It can also get into groundwater through industrial disposals of waste products.

Range in untreated UK groundwater <0.003 to 466.1 µg/L

M

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Magnesium (Mg) (see Total Hardness)

Magnesium is a common element, making up about 2% of the Earth's crust and is essential for plant and animal life. It's used in the production of light-weight alloys, medicines, paper, textiles, food and fertilizers. It's one of the main causes of hardness in water.

UK DWS 50 mg/L

Range in untreated UK groundwater <0.462 to 689 mg/L

Malathion

Malathion is considered to be one of the safest organophosphate insecticides, and has been used in large pest eradication programs. It's also used to control pests in domestic gardens and golf courses. Residues can travel long distances in the air, and it's able to leach from soil to groundwater. It will degrade quickly in alkaline water.

General UK DWS for pesticides 0.1 µg/L

Manganese

Manganese is mainly used in manufacturing iron, steel, and other alloys. Manganese compounds are used in batteries, glass, and fireworks. Potassium permanganate is used as an oxidant for cleaning, bleaching, and disinfection. Manganese may naturally occur in groundwater, particularly where high iron concentrations occur. In the natural environment, manganese is typically found in iron oxide minerals forming underground rock strata. Where groundwater flowing through the rock is acidic enough to dissolve iron-oxides, any manganese present will also be dissolved.

UK DWS 50 µg/L

Range in untreated UK groundwater <0.002 to 6810 µg/L

MCPA and MCPB [Methylchlorophenoxyacetic acid and Methylchlorophenoxybutanoic acid] (see Chlorophenoxy herbicides)

MCPA is a herbicide used to control annual and perennial weeds in cereals, grassland, and turf. It won't remain in the soil for long, but will leach into groundwater, where it's quickly broken down by microbes.

General UK DWS for pesticides 0.1 µg/L

Mecoprop

(see Chlorophenoxy herbicides)

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.002 to 1.6 µg/L

Mercury

Mercury is found naturally in the environment in small amounts. It's used in electrical appliances (lamps, arc rectifiers, mercury cells), in industrial and control instruments (switches, thermometers, barometers), in laboratory apparatus, and in dental amalgams. It's also a raw material for various mercury compounds, which are then used as fungicides, antiseptics, preservatives, pharmaceuticals, electrodes and reagents. Most of the mercury in the environment is from emissions to air by coal fired power plants and burning wastes.

UK DWS 1 µg/L

Range in untreated UK groundwater <0.008 to 2.6 µg/L

Metalaxyl

Metalaxyl is a fungicide used to control diseases like downy mildews and late blights. It may be used on many different crops, including tobacco, ornamentals, conifer, and turf applications.

General UK DWS for pesticides 0.1 µg/L

Metazochlor

Metazochlor is a selective herbicide that stops germination. It's used to control winter and annual grasses and broad-leaved weeds, mainly in oil seed rape crops.

General UK DWS for pesticides 0.1 µg/L

Methabenzthiazuron

Methabenzthiazuron is a herbicide used to control a range of broad-leaved weeds and grasses in cereals, legumes, maize, garlic and onions. It's used in combination with other herbicides in vineyards and orchards.

General UK DWS for pesticides 0.1 µg/L

Methane

Groundwater containing methane is typically found in areas where gas and oil wells are common, or in the vicinity of landfills. Methane has a strong odour and is highly flammable, so is very damaging to groundwater used as drinking water.

Range in untreated UK groundwater <0.5 to 3.7 mg/L

Methoxychlor

Methoxychlor is an organochlorine insecticide used to control livestock parasites and a variety of pests on ornamentals, fruits and vegetables. It doesn't tend to persist when released to soil or water. Some may leach into groundwater if it's released to soil. Under certain conditions, methoxychlor is broken down by microbes in the soil and sediment. It degrades within days in water.

UK DWS 0.03 µg/L

Typical values Up to 50 µg/L where applied to land

Metsulfuron - methyl

Metsulfuron is a herbicide used to control broad-leaved weeds in cereal crops. It does not bio-accumulate in fish. It can leach from soil into groundwater.

General UK DWS for pesticides 0.1 µg/L

Mevinphos

Mevinphos is a broad range, organophosphate insecticide used to control a variety of insects, including aphids, grasshoppers, leafhoppers, cutworms, caterpillars on a variety of field, forage, vegetable and fruit crops. It is also used to control mites and ticks. Mevinphos is very mobile in sandy loam, silt loam, loam, and clay loam soils especially where the soil is wet.

General UK DWS for pesticides 0.1 µg/L

Monolinuron

Monolinuron is a herbicide used for potatoes, leeks and French beans. It can also be used to control algae on lined domestic ponds. It can easily enter groundwater.

General UK DWS for pesticides 0.1 µg/L

Monuron

Monuron is a non-selective herbicide which prevents photosynthesis. It's used to control grasses and weeds in non-crop areas such as rights-of-way, industrial sites, railway lines and drainage ditch banks.

General UK DWS for pesticides 0.1 µg/L

MTBE

MTBE (methyl-t-butyl ether) is used in gasoline throughout the United States to reduce the carbon monoxide and ozone levels caused by vehicle emissions. Releases of MTBE to ground and surface water can occur through leaking underground storage tanks and pipelines, spills, emissions from marine engines into lakes and reservoirs, and deposits from the air.

WHO guideline value 15 µg /L

Range in untreated UK groundwater <0.1 to 67 µg/L

N

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Naphthalene (see PAHs)

Man-made sources of naphthalene include the incomplete combustion of fossil fuels, coke oven emissions and aluminium. It's released to air through burning fossil fuels, and can get into water through industrial discharges. It breaks down easily so won't build up in the environment.

UK DWS total PAHs 0.1 µg/L

Range in untreated UK groundwater <0.1 to 2.7 µg/L

Napropamide

Napropamide is used to control several grass and broadleaf weeds in orchards and vineyards. It's also effective for weed control in direct seeded tomatoes, strawberries, tobacco, peppers, ornamentals, and other crops. It can contaminate groundwater if it's discharged onto sandy soils which contain very little clay or organic material and where there is a shallow water table.

General UK DWS for pesticides 0.1 µg/L

Neburon

Neburon is a herbicide.

General UK DWS for pesticides 0.1 µg/L

Nickel

Nickel occurs naturally in soils and water (including groundwater). It's used in stainless steel, batteries, and in the coating of chromium-plated taps and fittings used for household water supply.

UK DWS 20 µg/L

Range in untreated UK groundwater <0.1 to 299 µg/L

Nitrate (NO₃) and Nitrite (NO₂)

Nitrate and nitrite are both naturally occurring ions. Nitrate is used mainly in inorganic fertilisers, and sodium nitrite is used as a food preservative, especially in cured meats. The nitrate concentration in groundwater and surface water is normally low but can reach high levels as a result of leaching or runoff from agricultural land, or contamination from human or animal wastes. In most countries, nitrate levels in drinking-water from surface water are not greater than 10 mgN/L, although nitrate levels in groundwater can be far higher.

Note: We normally report nitrate and nitrite concentrations as milligrams of nitrogen (N) derived from either nitrate or nitrite (i.e. NO₃ or NO₂) per litre of sample (mg N/L).

Other water quality reports (e.g. from Local Environmental Health departments) may provide the concentration of the nitrate or nitrite in milligrams per litre of dissolved compound (mg/L NO₃ or NO₂). Converting between the two versions is simple using the following formulas.

For **nitrate** use

$$1) \quad N(\text{mg} / \text{L}) \times \frac{31}{7} = \text{NO}_3(\text{mg} / \text{L}) \text{ to convert nitrogen from nitrate to nitrate}$$

$$2) \quad \text{NO}_3(\text{mg} / \text{L}) \times \frac{7}{31} = N(\text{mg} / \text{L}) \text{ to convert nitrate to nitrogen from nitrate}$$

For **nitrite** use

$$1) \quad N(\text{mg} / \text{L}) \times \frac{23}{7} = \text{NO}_2(\text{mg} / \text{L}) \text{ to convert nitrogen from nitrite to nitrite}$$

$$2) \quad \text{NO}_2(\text{mg} / \text{L}) \times \frac{7}{23} = N(\text{mg} / \text{L}) \text{ to convert nitrite to nitrogen from nitrite}$$

Nitrate UK DWS 11.3 mg of N/L from nitrate **or** 50 mg/L NO₃

Range in untreated UK groundwater <0.1 to 73.1 mg N/L

Nitrite UK DWS 0.16 mg of N /L from nitrite **or** 0.5 mg/L NO₂

Range in untreated UK groundwater <0.001 to 6.7 mg N/L

O

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Orthophosphate (PO₄)

Orthophosphate is produced by natural processes, but major sources from human activities include: partially treated and untreated sewage, run-off from agricultural sites and application of some lawn fertilisers.

Orthophosphate is found in very low concentrations in unpolluted waters. Poly-orthophosphates are used for treating boiler waters and in detergents. They transform into orthophosphate in water and can be absorbed by plants.

Range in untreated UK groundwater <0.02 to 2706 µg/L

P

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PAHs - see Polynuclear aromatic hydrocarbons

Parathion-ethyl and Parathion-methyl

Parathion is a widely used insecticide to treat soils before harvest for a variety of crops, both outdoors and in greenhouses. Parathion released to the environment isn't likely to leach in large amounts. It disappears from surface waters in about a week.

Parathion-methyl is an insecticide and acaricide for use on many crops, in particular cotton. This substance binds to soil and so will not travel into groundwater. It is broken down by microbes and in water. Concentrations of methyl parathion in natural waters of agricultural areas in the United States ranged up to 0.46mg/litre, with highest levels in summer.

General UK DWS for pesticides 0.1 µg/L

PCB (total) - Polychlorinated biphenyl or Pentachlorobiphenyl

Polychlorinated biphenyls (PCBs) are used in high power transformers and capacitors, in paint, plastics and sealants. They have been used in resins, inks, printing, copy paper and adhesives. PCBs are very persistent in soil and water, with no known break down processes other than slow degradation by microbes. They either bind to soils or evaporate, so won't usually leach to groundwater. PCB-contaminated sediments in lakes or rivers can slowly release PCB back into water, from which it eventually evaporates.

UK DWS 0.1 µg/L

Pentachlorophenol (PCP)

Pentachlorophenol (PCP) is used as a wood preservative (fungicide). It was once widely used as a herbicide, but was banned in the United States in 1987. When released to soil or water, PCP will be slowly broken down by microbes and may gradually leach into groundwater. If released in water, it will bind with the sediment, or be degraded by sunlight. PCP does build up in fish. (*USEPA*)

WHO guideline value 9 µg/L

Typical values outside UK < 10 mg/L but can be much higher in groundwater

Permethrin-cis and Permethrin-trans

Permethrin is a contact insecticide used against a range of pests in agriculture, forestry, and public health. It's also used to control aquatic invertebrates found in water mains. It binds strongly to soil and is broken down by microbial action and by sunlight.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater

Permethrin-cis < 0.001 to 0.08 µg/L

Permethrin-trans <0.001 to 0.278 µg/L

pH

The pH of water is a measure of the acid-base equilibrium. In most natural waters, this is controlled by the balance between carbon dioxide, bicarbonate and carbonate molecules dissolved in the water. An increased carbon dioxide concentration will lower pH, whereas a decrease will cause it to rise. Temperature also affects pH. The pH of most untreated groundwater lies within the range 6.5-8.5. The pH of water is very important in determining how corrosive the water is, i.e. how quickly metal pipes and tanks used to store the water will be corroded. In general, the lower the pH, the higher the level of corrosion (*WHO*).

UK DWS 5.5-9.5 max 10

Range in untreated UK groundwater 4.7 to 9.6

Phenanthrene (see PAHs for full description)

UK DWS total PAHs 0.1 µg/L

Phenol

Phenol is primarily a man-made chemical, although it is found naturally in animal wastes and decomposing organic material. It was first isolated from coal tar in 1834 and called carbolic acid. Phenol is used for the production of phenolic resins, which are used in the plywood adhesive, construction, automotive, and appliance industries. Phenol is also used to kill bacteria and fungi; as a disinfectant; and as an anaesthetic in medicinal preparations including ointments, ear and nose drops, cold sore lotions, throat lozenges, and antiseptic lotions. It's released to soil through leaching from hazardous waste sites and landfill sites, and it's also released to air through industrial processes.

Range in untreated UK groundwater <0.01 to 135 µg/L

Pichloram

Pichloram is used as a herbicide for controlling annual weeds on crops. It's also used with 2,4-D or 2,4,5-T against perennial weeds on un-cropped land for brush control. Although its broken down by microbes in soil, Pichloram doesn't bind to soil. If it's not completely biodegraded it can leach into groundwater. Pichloram doesn't build up in aquatic animals.

General UK DWS for pesticides 0.1 µg/L

Pirimicarb

Pirimicarb is a selective insecticide used mainly on wheat, peas, potatoes and sugar beet.

General UK DWS for pesticides 0.1 µg/L

Pirimiphos-methyl and Pirimiphos-ethyl

Pirimiphos-methyl is a broad-spectrum insecticide. Pirimiphos-ethyl is an insecticide widely used to kill pests of banana, crops, ornamental plant, turf, vegetable, etc. It also can be used to treat seeds, and kill mosquitoes and flies in mixed fertiliser for mushrooms.

General UK DWS for pesticides 0.1 µg/L

Polynuclear aromatic hydrocarbons (PAHs)

Most PAHs enter the environment via the atmosphere from a variety of combustion processes. Although not usually found in untreated water, PAH contamination in drinking-water can occur from the coal-tar coating of drinking-water distribution pipes, used to protect the pipes from corrosion. PAHs have been detected in a variety of foods where they have formed during cooking by charbroiling, grilling, roasting, frying or baking.

PAHs Total UK DWS 0.1 µg/L

Potassium

Potassium is the seventh most abundant metal on earth. Most potassium minerals are insoluble in water and the metal is obtained from them with great difficulty. The metal is released slowly from rocks as they are weathered. Potassium is essential for plant growth and is found in most soils. It is mainly used in fertilizers.

UK DWS 12 mg/L

Range in untreated UK groundwater <0.05 to 220 mg/L

Prochloraz

Prochloraz is a fungicide used against a wide range of diseases affecting field crops, fruit, turf and vegetables.

General UK DWS for pesticides 0.1 µg/L

Promethryne

Promethryne is a nitrogen containing pesticide.

General UK DWS for pesticides 0.1 µg/L

Propachlor

Propachlor is a herbicide used to control annual grasses and some broad-leaved weeds in beans, brassicas, cotton, groundnuts, leeks, maize, onions, peas, roses, ornamental trees and shrubs, sugarcane, fennel, flower crops, flax, oilseed rape, strawberries and pumpkins. In a US survey, propachlor was detected in 2 of 99 groundwater samples collected from 94 wells at a maximum concentration of 0.12 µg/L. Propachlor is broken down by microbes.

UK DWS for organochlorine compounds 0.3 µg/L

Typical values outside UK 0.52-2.98 µg/L (USA)

Propazine

Propazine is a herbicide used to control broadleaf weeds and annual grasses in sweet sorghum. It's highly persistent in the soil environment, but is eventually broken down by microbes within years. It may contaminate groundwater, especially in areas where the soil has very little organic matter and clay content, and there is high rainfall, high irrigation rates or propazine is applied excessively. In a study in the US propazine was detected in 15 out of 906 groundwater samples collected from eight US states with a maximum concentration of 0.013 mg/L.

General UK DWS for pesticides 0.1 µg/L

Propetamphos

Propetamphos is an organophosphate insecticide used in households and public health to control cockroaches, flies, ants, ticks, moths, fleas and mosquitoes. It's also used to control skin parasites such as ticks and skin lice on cattle and pets. If it gets into surface water it's broken down by sunlight.

General UK DWS for pesticides 0.1 µg/L

Propyzamide

A residual herbicide used on a wide range of crops.

General UK DWS for pesticides 0.1 µg/L

Pyrene (see PAHs)

UK DWS for total PAHs 0.1 µg/L

S

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Selenium

Selenium is present in the Earth's crust and is an essential trace element. Foodstuffs such as cereals, meat and fish are the principal source of selenium for people.

UK DWS 10 µg/L

Range in untreated UK groundwater <0.015 to 121.3 µg/L

Silica (dissolved)

Silicon is present in the Earth's crust, and when its combined with oxygen it forms silica (SiO₂). Silica doesn't easily dissolve in cold water, though it has been found in warm groundwater. It can cause scale to build up if present in domestic water supplies.

Silver

Silver is used in photographic materials and alkaline batteries, or as the element in electrical equipment, hard alloys, mirrors, chemical catalysts, coins, table silver, and jewellery. Soluble silver compounds may be used as external antiseptic agents (typical concentration 15-50 µg/L)

of product) and as a disinfectant (>150 µg/L).

Range in untreated UK groundwater <0.0008 to 7.9 µg/L

Simazine

Simazine is a herbicide used to control broad-leaved and grass weeds in artichokes, asparagus, berries, broad beans, citrus fruits, coffee, cocoa, hops, maize, oil palms, olives, orchards, ornamentals, sugar-cane, tea, tree nurseries, turf, and vineyards, as well as in non-crop areas. Simazine can remain in soil for a few months up to a few years, depending on how quickly it's broken down by microbes. Simazine can leach into groundwater. It's unlikely to build up in fish.

General UK DWS for pesticides 0.1 µg/L

Range in untreated UK groundwater <0.001 to 37.5 µg/L

Sodium

Sodium occurs naturally in the environment as a result of leaching of salt deposits. It's used as a coolant in nuclear reactors, in electric power cables, in non-glare lighting for roads, and as a heat-transfer medium in solar-powered electric generators. Sodium salts are used in water treatment, including softening, disinfection, corrosion control, pH adjustment; in road de-icing, and in the paper, glass, soap, pharmaceutical, chemical, and food industries.

UK DWS 150 mg/L

Typical values <2.2 to 5820 mg/L

Strontium

Strontium can occur in groundwater as a result of the interaction of groundwater with calcium-rich rocks, like limestone and chalk, over long periods of time.

Styrene

Styrene is used to produce plastics and resins, and is released into the environment by emissions and effluents from the production process. It has been found in exhausts from spark-ignition engines, oxy-acetylene flames, and cigarette smoke. The emissions from waste incinerators can also contain styrene as can polymer resin products used in fibreglass construction of boats and auto body fillers. Whilst it has been detected in various drinking waters, it wasn't detected in a groundwater supply survey of 945 groundwater sources in the US.

WHO 20 µg/L

USEPA 100 µg/L

Typical Values <0.1 µg/L or not detected in groundwater (Germany)

Sulphate

Sulphate occurs naturally in lots of minerals and is used commercially in the chemical industry. Sulphate is discharged into water in industrial wastes, but the highest levels found in groundwater are usually from natural sources, such as the mineral gypsum. Sulphates and sulphuric acid products are used to make fertilisers, chemicals, dyes, glass, paper, soaps, textiles, fungicides, insecticides, astringents, and emetics. They are also used in the mining, woodpulp, metal, and plating industries, in sewage treatment, and in leather processing. Aluminium sulphate (alum) is used to treat drinking-water. Copper sulphate has been used to control of algae in raw and public water supplies.

UK DWS 250 mg/L

Range in untreated UK groundwater <0.02 to 1790 mg/L

Sulphide

Sulphide occurs naturally in mineral ores, oil and coal deposits. Hydrogen sulphide is a product of anaerobic breakdown of organic matter which contains sulphur. It is a gas with a characteristic odour of rotten eggs. It's generated by sulphate-reducing bacteria through anaerobic breakdown of sewage, algae, and soils, and the sulphur found in fungicides, pesticides and fertilisers. Industrial wastes from petroleum and petrochemical plants, gas works, paper mills, heavy water plants and tanneries can also contain sulphide.

T

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2,4,5 –TP (also known as Fenoprop)

2,4,5-TP has been banned in the US since 1985. It was used as a herbicide to control woody plants, and broadleaf herbaceous weeds in rice and bluegrass turf, in sugarcane and on lawns. Aquatic uses included control of weeds in ditches and riverbanks, along canals, reservoirs and streams. 2,4,5-TP strongly binds to soils and is broken down by microbes, so it isn't likely to leach to groundwater. It's unlikely to build up in aquatic life.

General UK DWS for pesticides 0.1 µg/L

Reported values outside UK Less than 17 mg/L in Canadian groundwater

Tetrachlorodiphenylethane, TDE OP or TDE PP (or DDD Dichlorodiphenyldichloroethane)

TDE is used to control insects. If released to soil it won't generally leach to the groundwater, although it has been detected in groundwater samples. It will slowly break down in soil. If released into water it will build up in aquatic animals and plants and sediments, and will only slowly break down.

General UK DWS for pesticides 0.1 µg/L

Reported value outside UK up to 0.4 µg/L or not detected (USA)

Tecnazene

Tecnazene is used to stop stored potatoes sprouting and as a fungicide in greenhouses.

General UK DWS for pesticides 0.1 µg/L

Temperature (Temp) degrees centigrade

Soil, rock and water are relatively poor conductors of heat compared to air. This means the temperature of groundwater, at 10 to 20m below ground remains relatively constant year round and should be close to the local mean air temperature. Below about 20m, groundwater temperature will increase with depth due to heating from the breakdown of radioactive minerals in the Earth's crust.

Typical UK groundwater values 10-15 degrees C year round

Terbutryn

Terbutryn is a selective herbicide used to control most grasses and many annual broadleaf weeds in winter wheat, winter barley, sorghum, sugarcane, sunflowers, peas, and potatoes. It's also used as an aquatic herbicide to control weeds and algae in water-courses, reservoirs, and fish ponds. Terbutryn is readily adsorbed in soils with high organic or clay content. Depending on how often it's applied, terbutryn can remain in soil for 3 to 10 weeks. Although, studies have shown that terbutryn won't leach from soils, the chemical that it breaks down into, hydroxy terbutryn, is more mobile and could leach to groundwater. Terbutryn has been detected at some groundwater monitoring sites in England.

General UK DWS for pesticides 0.1 µg/L

Tertiary Amyl Methyl Ether (TAME)

Tertiary-Amyl Methyl Ether is used as a solvent and can enter groundwater through spills and leaks.

1,1,2,2–Tetrachloroethane and 1,1,1,2-Tetrachloroethane

1,1,2,2-Tetrachloroethane is a manufactured chemical used in the production of other chemicals, as a solvent to clean and degrease metals, and in paints and pesticides. Commercial production of 1,1,2,2-tetrachloroethane for these uses has stopped in the US. It's presently used only in the production of other chemicals.

When released to the environment 1,1,2,2-Tetrachloroethane eventually moves into the air or groundwater. It doesn't bind to soil particles when spread on land. When released to surface water, much of it will evaporate into the air while the rest may break down or decompose in the water. Breakdown of the chemical is slow and it takes about 13 months for half of the chemical to breakdown in groundwater and 2 months in air. 1,1,2,2-Tetrachloroethane does not build up significantly in the bodies of fish or other organisms.

UK DWS for Tetrachloroethane 10 µg/L

Range in untreated UK groundwater <0.003 to 7.22 µg/L

Tetrachloroethene

Tetrachloroethene is used primarily as a solvent in the dry-cleaning industry. It's also used as a degreasing solvent in metal industries and in the manufacture of fluorohydrocarbons. It can get into the environment through industrial releases. If it's released to soil it will slowly leach to groundwater, though it won't build up in the aquatic environment.

UK DWS 10 µg/L

Range in untreated UK groundwater <0.05 to 46 µg/L

2,3,5,6 Tetrachlorothioanisole

Break down product of the anti-sprouting agent tecnazene (see Tecnazene).

General UK DWS for pesticides 0.1 µg/L

2,3,5,6 Tetrchloroaniline

Break down product of the anti-sprouting agent Tecnazene (see Tecnazene).

General UK DWS for pesticides 0.1 µg/L

2,3,6 TBA - Terbutylazine

TBA is a herbicide used to treat a variety of agricultural crops and in forestry. The decomposition of TBA in surface or groundwater depends on whether microbes are present to break down the chemical.

General UK DWS for pesticides 0.1 µg/L

Typical values outside UK Concentrations in water seldom exceed 0.2 µg/L.

Thallium

Thallium is a metal that occurs naturally in the Earth's Crust. It is used in making glass for highly reflective lenses, in photocells, in low temperature thermometers, and its salts are used as reagents in chemical research. Thallium sulphate is still sold in developing countries where it is permitted as a pesticide, particularly as rat poison, although it's banned in some countries.

It is partially water-soluble and so it can spread with groundwater which has percolated through soils which contain the metal. It can also spread by adsorption on sewage sludge and it is likely to be fairly mobile in soils. It will bio-accumulate in aquatic organisms.

USEPA guideline value 2 µg/L

Tin

Tin is mainly used in the production of coatings for cans for food storage. It is also used increasingly in the solder for domestic plumbing and can be used to stop corrosion of metals. It will not bio-accumulate in humans.

Typical values in drinking water <1 µg/L

TOC Total Organic Carbon

The total organic carbon content of a water sample is the amount of carbon in the sample derived from organic chemicals. The TOC indicates the level of contamination by organic (carbon based) chemicals. These chemicals can occur naturally in soils, or are man-made pesticide and herbicides or industrial chemicals. Organic carbon in surface and groundwater usually comes from run-off from land, sewage effluent, and industrial spillages.

Range in untreated UK groundwater <0.1 to 36.71 mg/L

Toluene

Toluene is used as a solvent, especially for paints, coatings, gums, oils, and resins, and as raw material in the production of benzene, phenol, and other organic solvents. Most toluene is used in the blending of petrol. It gets into the environment through vehicle exhausts, and it's also released as waste water or by spills or leaks to land during storage, especially in underground tanks. If released to surface water it mostly evaporates. It does not bio-accumulate in aquatic life. Toluene can leach into groundwater.

WHO guideline value 700 µg/L

Range in untreated UK groundwater <0.05 to 58 µg/L

TON Total Oxidized Nitrogen

TON or the total oxidised nitrogen content of water is the sum of the concentrations of oxidised nitrogen compounds i.e. the sum of nitrate and nitrite in water. The TON content of surface water shows the ability of a water body to support an algal bloom.

Total Hardness

Water hardness is the traditional measure of how water reacts with soap. A lot more soap is needed to produce lather in hard water areas. Water hardness is caused by a variety of dissolved substances. The main natural sources of hardness in water are dissolved calcium and magnesium ions from sedimentary rocks (limestone, chalk and sandstone), seepage, and run-off from soils. These ions are also present in a wide variety of industrial products and are common constituents of food. Other ions that can contribute to water hardness include aluminium, barium, manganese, iron, strontium and zinc.

Triazophos

Triazophos is a man-made insecticide which can be toxic to wildlife. It's released into the environment through usage and whilst being transported and stored.

General UK DWS for pesticides 0.1 µg/L

Trichlorobenzenes

1,2,4 Trichlorobenzene, 1,2,3 Trichlorobenzene and 1,3,5 Trichlorobenzene (TCB)

Trichlorobenzenes (TCBs) are released to the environment during their manufacture and use as industrial chemicals and solvents. TCBs are found in drinking-water, but rarely at levels above 1mg/L.

Normally a mixture of 1,2,4 and 1,2,3 TCB is used for industrial processes. The mixture is used as a solvent, a coolant, a lubricant, and a heat-transfer medium; in polyester dyeing, and as an insecticide. It's also used to make herbicides, and is found in wood preservatives and in abrasives. It was once used as a soil treatment for termite control.

1,2,4-TCB binds well to the soil, so shouldn't leach easily into groundwater. However, it has been detected in some groundwater samples. If released to surface water 1,2,4-TCB should mostly evaporate within a few hours if released to surface water. It can bio-accumulate in fish.

General UK DWS for pesticides 0.1 µg/L

Typical value outside UK 1.2 µg/L in groundwater in the Netherlands

Trichlopyr (see Carboxylic acid herbicides)

Trichloroethane, Trichloroethane-1,1,1 or Trichloroethane-1,1,2

Trichloroethane is widely used as a cleaning solvent for electrical equipment, motors, electronic instruments and upholstery. It's also used as a solvent for adhesives, coatings, textile dyes, as a coolant and lubricant in metal cutting oils, as a component in inks and drain cleaners and as an inhalation analgesic and anaesthetic. Trichloroethane may be released directly into wastewater, deposited in water from the atmosphere, or formed as a by-product during water chlorination.

1,1,1-Trichloroethane (1,1,1-TCA) is used as a solvent to remove grease from machined metal products, in textile processing and in aerosols. 1,1,1-TCA will evaporate rapidly from water and soil. It doesn't bind to soils and isn't broken down by microbial action, so it may leach to ground water. It doesn't build up in aquatic organisms.

UK DWS 10 µg/L

Trichloroethane range in untreated UK groundwater <0.05 to 98 µg/L

Trichloroethane-1,1,1 range in untreated UK groundwater <0.1 to 0.69 µg/L

Trichloroethene

A solvent which can be introduced into groundwater from poor storage or spillages at industrial sites.

UK DWS 10 µg/L

Range in untreated UK groundwater <0.05 to 7160 µg/L

Trichlorophenol-2,4,5 (see chlorophenols)

This chemical is a primary break down product of 2,4,5 T or Fenoprop.

WHO guideline value 0.1 µg/L

Trichlorophenol-2,4,6 (see chlorophenols)

WHO guideline value 0.2 mg/L

Trietazine

A selective herbicide used to control weeds in pea and potato crops.

General UK DWS for pesticides 0.1 µg/L

Trifluralin

Trifluralin is a herbicide used to control annual grasses and broad-leaved weeds in beans, brassicas, cotton, groundnuts, forage legumes, orchards, ornamentals, transplanted peppers, soy beans, sugar-beet, sunflowers, tomatoes, and vineyards. The break down products of Trifluralin may contaminate drinking-water sources. Trifluralin should not leach to groundwater.

General UK DWS for pesticides 0.1 µg/L

Typical Values Rarely detected in groundwater in USA / Italy

Trihalomethanes (bromoform, bromodichloromethane, dibromochloromethane, chloroform)

Trihalomethanes (THMs) are produced when drinking water is chlorinated. In untreated or non-chlorinated groundwater THMs may occur due to the poor disposal of solvents to ground. Usually THMs will evaporate from water when exposed to air.

UK DWS 100 µg/L

Range in untreated UK groundwater < 0.05 to 64 µg/L

U

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Uranium occurs naturally in rocks such as granite, and in various mineral deposits. It's used mainly as fuel in nuclear power stations. It is present in the environment as a result of leaching from natural deposits, release in mill tailings, emissions from the nuclear industry, the combustion of coal and other fuels and the use of phosphate fertilizers that contain uranium. Uranium concentration is normally extremely low in drinking water at < 0.1 µg/L. In areas where groundwater is abstracted from aquifers made of granite the concentration of uranium can be substantially higher.

WHO guideline value > 0.015 mg/L

V

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Vanadium

Vanadium is a naturally occurring metal, used in industry as an additive to improve steel. Vanadium in groundwater may result from water-rock interaction, or as a result of human activities that have produced contaminated land.

UK DWS 250 mg/L

Range in untreated UK groundwater <0.1 to 33.9 µg/L

Vinyl Chloride {Chloroethenyl}

Vinyl chloride is mainly used to produce polyvinyl chloride (PVC), vinyl acetate and trichloroethane. It can get into the environment through improper disposal of chemical wastes. If it's released to soil it will evaporate or be broken down by microbes. It will evaporate from water and won't build up in aquatic plants or animals.

UK DWS 0.5 µg/L

Typical Values 1-1.7 µg/L

X

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Xylenes

Xylene is used in the manufacture of insecticides and pharmaceuticals, as a component of detergents, and as a solvent for paints, inks, and adhesives. Xylene-containing petroleum distillates are commonly used in blending petrol. They are released to the environment in the air, and human exposure is increased by smoking. Xylenes are moderately mobile in soil and may leach into groundwater, where they can remain for several years. They do eventually breakdown in both soil and groundwater.

General UK DWS for pesticides 0.1 µg/L

WHO guideline value 500 µg /L

Xylene-o Range in untreated UK groundwater <0.1 to 33 µg/L

Xylene-p, Xylene-m Range in untreated UK groundwater <0.2 to 105 µg/L

Xylenol

A derivative of xylene used as a pesticide.

General UK DWS for pesticides 0.1 µg/L

Z

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Zinc

Zinc is an essential trace element found naturally in virtually all food and potable water in the form of salts or organic complexes. Zinc levels in surface water and groundwater are normally lower than 0.01 and 0.05 mg/litre respectively, though concentrations in tap water can be much higher as a result of dissolved zinc from pipes.

UK DWS 5000 µg/L

Range in untreated UK groundwater <0.1197 to 23500 µg/L