Department
for Environment
Food & Rural Affairs

Drinking water quality in England: a triennial report 2017-2019

Date: December 2021

Version: 1

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Introduction

This is the first three yearly report on the quality of drinking water supplies in England. It covers the quality of public supplies and the largest private supplies serving more than 5,000 consumers, or 1,000 cubic metres a day.

This report demonstrates the high quality of drinking water in England. For public supplies, of the many thousands of samples taken by water companies (water supply licensees and wholesale licensees) during 2017 to 2019, 99.95% met the regulatory standards. Every sample that failed to meet the standards was investigated and actions put in place to protect consumers and prevent recurrence. High-quality supplies in England do not occur by accident but through the work of the many stakeholders involved in drinking water treatment and supply. The Water Safety Planning approach included in our drinking water legislation, ensures any risks are identified and dealt with effectively before they become a problem. This approach, supported by targeted enforcement action, ensures that public health remains a priority at all times.

Since 2010, when legislation was introduced, the quality of private supplies has been improving, but they still lag behind the standards of the public supplies. During 2017 to 2019, the largest supplies met the regulatory standards for 97.60% of the time.

Local authorities are the regulators of private water supplies. They are responsible for carrying out a risk assessment and monitoring and can serve notices if they determine a supply is unwholesome, and must serve a notice if they determine there is a potential risk to human health.

Where does our tap water come from?

Public water supplies

Approximately 99% of the population of England receive a public supply from a water company. Consumers will know whether they receive a public supply, because they will be billed by a water company for their drinking water supply. Fourteen thousand megalitres of water were supplied each day to a population of fifty-five million people in England. This is equivalent to about 5,600 Olympic sized swimming pools every day. The population served has increased slightly over the period of this report. The figures for 2017 to 2019 are shown in Table 1.

Table 1. Public supply statistics for England

		2017	2018	2019
Total population		55,353,874	55,581,180	56,209,949
Number of water supply zones		1497	1504	1558
Total volume of water supplied (Megalitres)		13,863	13,638	14,144
Water sources by percentage volume (surface, groundwater, other)	Ground	30%	30%	26%
	Surface	64%	63%	66%
	Mixed/Other	6%	7%	8%

Source: www.dwi.gov.uk/what-we-do/annual-report/

Water is abstracted from surface water (rivers and reservoirs), groundwater aquifers and mixed sources, with the largest proportion being supplied from surface water.

Before it reaches consumers taps, public supplies are treated to remove impurities, and distributed through a network of strategic water mains and storage tanks called service reservoirs, before local water mains carry supplies into people's homes.

The number of water treatment works, service reservoirs and water supply zones in the public supply network in England are shown in Table 2.

Table 2. Number of water company assets in England (Chief Inspector's Report)

	2017	2018	2019
Water treatment works	1,101	1,050	1,090
Service reservoirs	3,802	3,773	3,773
Water supply zones	1,497	1,503	1,558

Private water supplies

About one percent of the population of England have a private water supply, commonly a farm, or small rural community. These consumers often abstract their water from a well, spring or borehole on private land.

As explained in the Introduction, this report covers the quality of the largest private supplies of which there are 11 serving a population of almost 300,000. These supplies are mostly used as part of a commercial or public activity such as drinks manufacturing or hospitals.

Quality standards for drinking water

Drinking Water is regulated under the Water Supply (Water Quality) Regulations 2016 (as amended), and the Private Water Supplies (England) Regulations 2016 (as amended).

Both sets of regulations include standards for a wide range of microbiological and chemical parameters, plus indicator parameters and pesticides. Many are health-based standards and contain safety margins to protect the most vulnerable members of society. Other standards ensure that water is aesthetically pleasing and acceptable to consumers.

The two microbiological parameters Escherichia coli and Enterococci should be absent from drinking water to guarantee its quality. Some parameters reflect the acceptability of water to the consumer, such as appearance, taste and odour of the water. Other chemical parameters are selected for their potential impact on human health. Chemical parameters are almost never present in drinking water in concentrations that can cause acute health

effects. Furthermore, the impact of any parameter exceeding the safety limit or the non-compliance of chemical usage and disposal, depends on the way they affect the human body. Mostly the parametric values are based on lifelong exposure and an average drinking water intake of two litres per person per day.

The Drinking Water Inspectorate (the Inspectorate) was established in 1990 to provide independent assurance that the water industry delivers safe, clean drinking water to consumers. They hold water companies to account and take action to ensure any failures are addressed. They also provide technical and scientific advice to local authorities (who are the regulators of private water supplies). Information on the regulatory work of the Inspectorate can be found on the website dwi.gov.uk.

Sampling results for public water supplies

Water supplies are sampled throughout the supply chain to confirm water remains safe to drink and free from contamination. In addition, a random selection of consumer properties is sampled each year. Samples are taken at the point of supply, usually the kitchen tap, and analysed to check they meet the regulatory standards.

The percentage compliance for the main parameter groups is shown in Table 3.

Table 3. Compliance measured at consumers taps and supply points for public supplies

Parameter group	2017	2018	2019
Microbiology	99.98%	99.98%	99.98%
Chemicals	99.94%	99.94%	99.94%
Indicator parameters	99.95%	99.94%	99.94%
Pesticides	99.98%	99.99%	100.00%

Drinking water supplies are generally and consistently compliant with the standards in the Regulations, although each year a small number of samples failed to meet the standards. The exact numbers of samples and failures for each parameter is shown in Tables 4 to 7.

The majority of substances met the regulatory standards all of the time (100% compliance). Lead and nickel had the poorest performance with lead (99.38%) and nickel (99.74%), followed by coliforms (99.78%), odour (99.78%), iron (99.82%), and taste (99.90%).

Table 4. Compliance data 2017 – 2019 for microbiological parameters in zones and supply points combined

Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
Escherichia coli	143,628	26	144,481	20	144,104	32	99.98
Enterococci	11,508	4	11,569	4	11,589	3	99.97

Table 5. Compliance data 2017 – 2019 for chemical parameters in zones and supply points combined

Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
1 2-Dichloroethane	9,823	0	9,921	0	9,999	0	100.00
Aluminium	41,093	13	45,366	8	47,200	14	99.97
Antimony	11,499	0	11,553	0	11,602	0	100.00

Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
Arsenic	11,491	0	11,582	0	11,601	0	100.00
Benzene	9,814	0	9,917	0	10,021	0	100.00
Benzo[a]Pyrene	11,736	7	11,884	2	11,868	4	99.96
Boron	9,665	0	9,665	0	9,922	0	100.00
Bromate	10,631	0	10,810	1	10,824	0	100.00
Cadmium	11,499	0	11,555	0	11,602	0	100.00
Chromium	11,498	0	11,552	0	11,600	0	100.00
Colour	45,751	0	49,647	0	51,763	0	100.00
Copper	11,486	3	11,559	0	11,608	2	99.99
Cyanide	8,073	0	8,109	0	8,228	2	99.99
Fluoride	9,971	0	10,330	0	10,353	0	100.00
Iron	45,827	70	47,455	87	47,720	101	99.82
Lead	11,488	69	11,555	78	11,607	69	99.38
Manganese	42,281	16	45,980	13	47,169	17	99.97
Mercury	8,078	0	8,097	0	8,287	0	100.00
Nickel	11,486	30	11,561	31	11,585	28	99.74
Nitrate	21,308	0	21,666	0	21,780	2	100.00
Nitrite - Consumer's Taps	21,454	1	21,674	0	21,801	3	99.99

Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
Nitrite/Nitrate formula	21,278	1	21,628	0	21,743	2	100.00
Odour	37,204	100	47,086	91	51,937	103	99.78
Polycyclic Aromatic Hydrocarbons	11,574	2	11,775	0	11,760	1	99.99
Selenium	11,492	0	11,794	0	11,603	0	100.00
Sodium	11,498	0	11,541	1	11,629	0	100.00
Taste	37,186	38	47,009	43	51,831	57	99.90
Tetra-chloromethane	11,151	0	11,321	0	11,233	0	100.00
Trichloroethene & Tetra-chloroethene	11,155	0	11,259	1	11,227	0	100.00
Trihalomethanes	11,758	1	11,900	4	11,756	0	99.99
Turbidity	48,723	3	51,174	2	51,728	8	99.99

Table 6. Compliance data 2017 – 2019 for indicator parameters in zones and supply points combined

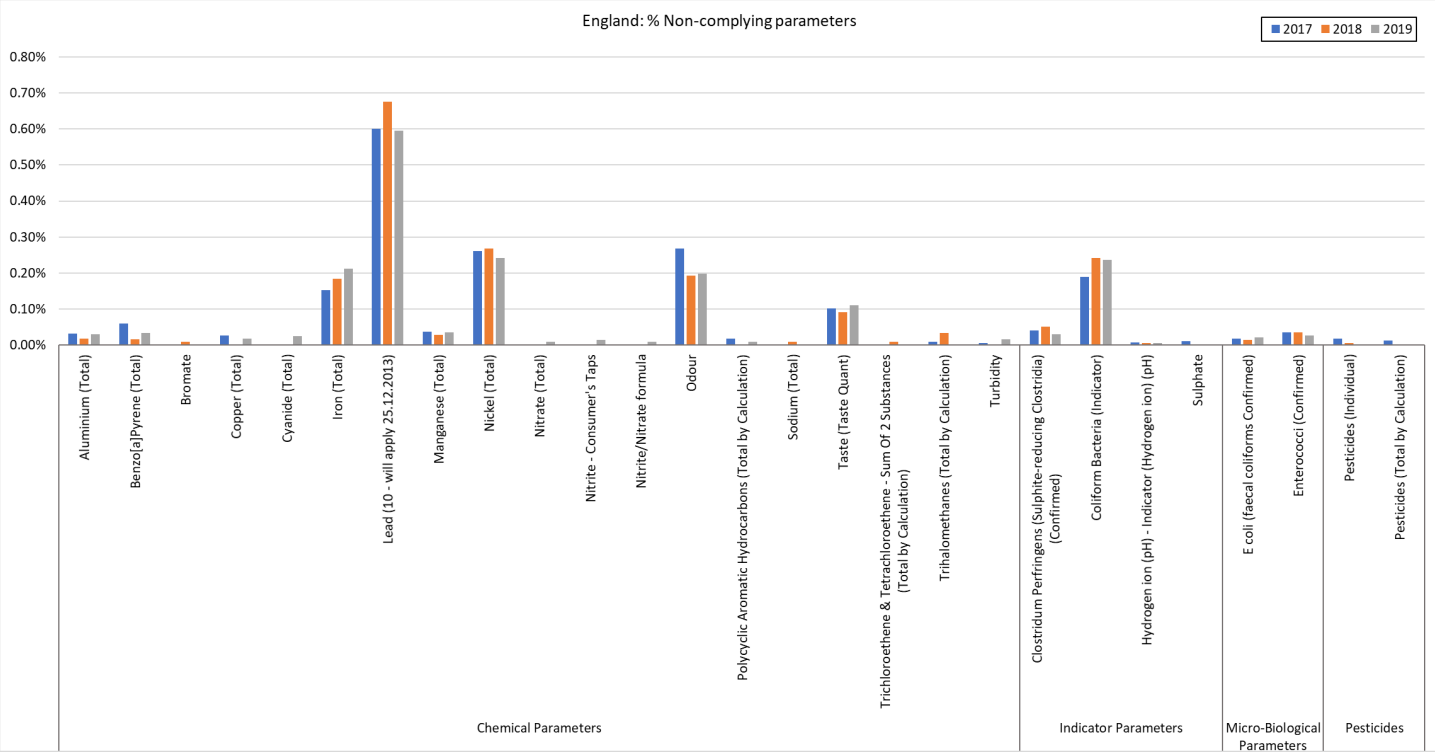
Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
Ammonium	39,369	1	45,906	1	40,010	1	100.00
Chloride	9,665	0	9,688	0	9,861	0	100.00
Clostridium Perfringens	41,989	17	40,709	21	29,532	9	99.96

Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
Coliform Bacteria	143,629	273	144,480	350	144,104	342	99.78
Colony Counts After 3 Days At 22°C	56,152	0	57,549	0	57,659	0	100.00
Conductivity	43,168	0	52,585	0	55,066	0	100.00
Hydrogen ion (pH)	45,808	3	50,216	3	51,574	3	99.99
Sulphate	9,557	1	9,572	0	9,851	0	100.00
Total Indicative Dose (Gross Alpha and Beta)	24	0	no data	no data	no data	no data	100.00
Total Organic Carbon	8,138	0	8,273	0	8,454	0	100.00
Tritium	1,000	0	512	0	270	0	100.00

Table 7. Compliance data 2017 – 2019 for pesticides in zones and supply points combined

Parameter	2017 Samples taken	2017 Fails	2018 Samples taken	2018 Fails	2019 Samples taken	2019 fails	Percentage compliance 2017-2019
Individual Pesticides	209,799	36	201,020	11	170,894	6	99.99
Special Pesticides	12,228	0	11,984	0	14,533	0	100.00
Total pesticides	8,195	1	7,754	0	8,277	0	100.00

Figure 1. Bar chart showing percentage of samples not meeting the standard



Lead

The lead failures come from lead plumbing which is present in some older buildings. Water companies treat drinking water with phosphate to provide a coating within lead pipes, and while this reduces the amount of lead which dissolves into the water, it is not completely effective. Water companies are tackling lead failures using a risk-based approach, prioritising schools and vulnerable consumers. The Inspectorate has published research on Long term strategies to reduce lead exposure from drinking water, and as part of the Government's green recovery initiative, two water companies are trialling innovative lead pipe replacement schemes.

Nickel

Nickel failures are sometimes found to be associated with the installation of new water fittings in the home for example new chrome taps. The nickel leaching from these products is often attributable to chrome/nickel or nickel-plated products and is variable depending on the plating process. The Inspectorate and UK Water Industry Research body (UKWIR) are carrying out a research project to look at possible methodology for quality assurance testing by water fittings manufacturers. More information about approved products can be found on the Inspectorate's website and advice for consumers finding approved plumbers on the WaterSafe website.

Coliforms

Coliforms are extremely common on surfaces and are used as an indicator of environmental contamination. In each case an investigation is carried out to investigate the cause and resamples are taken until the issue is resolved. Three quarters of coliform failures were traced to the kitchen tap, which highlights the need for consumers to keep the tap clean, although few of the remaining failures were attributable to any conclusive cause.

Iron and Manganese

Iron and manganese can be found in tap water as these metal deposits can accumulate in the pipe network. These deposits can come from a variety of sources, iron and manganese are found naturally in source waters and iron is used in the treatment process at water treatment works. Water companies will try to reduce the amount of iron and manganese leaving treatment works so these metals do not ‘seed’ the network. Unlined cast iron pipes can also be a source of iron, as corrosion of the metal pipe wall can happen over time and depending on the water chemistry. The mains sediments can collect in pipes and should there be a sudden change in water flow or direction, for example after a burst main or if the water company needs to re-route water around the network, these mains deposits can become disturbed and make their way through to the consumer’s tap. When this happens, consumers can sometimes experience discoloured water, which may be brown, black or orange in colour. Whilst often not harmful to health at the concentrations seen, receiving discoloured water is visually not appealing and can lead to rejection of the water. Water companies will manage the concentrations of iron and manganese in the network by implementing tighter controls at the treatment works and by undertaking maintenance activities in the network such as conditioning and flushing pipes and replacing ageing pipes.

Taste and odour

Taste and odour issues can be associated with consumer plumbing. Half of the taste samples and a third of the odour failures were found to be caused by deficiencies in the domestic plumbing. Other causes of taste and odour include algal breakdown products from rivers or reservoirs in the catchment. Where repeated failures occurred, the Inspectorate have taken action alongside companies to install treatment to remove taste and odour.

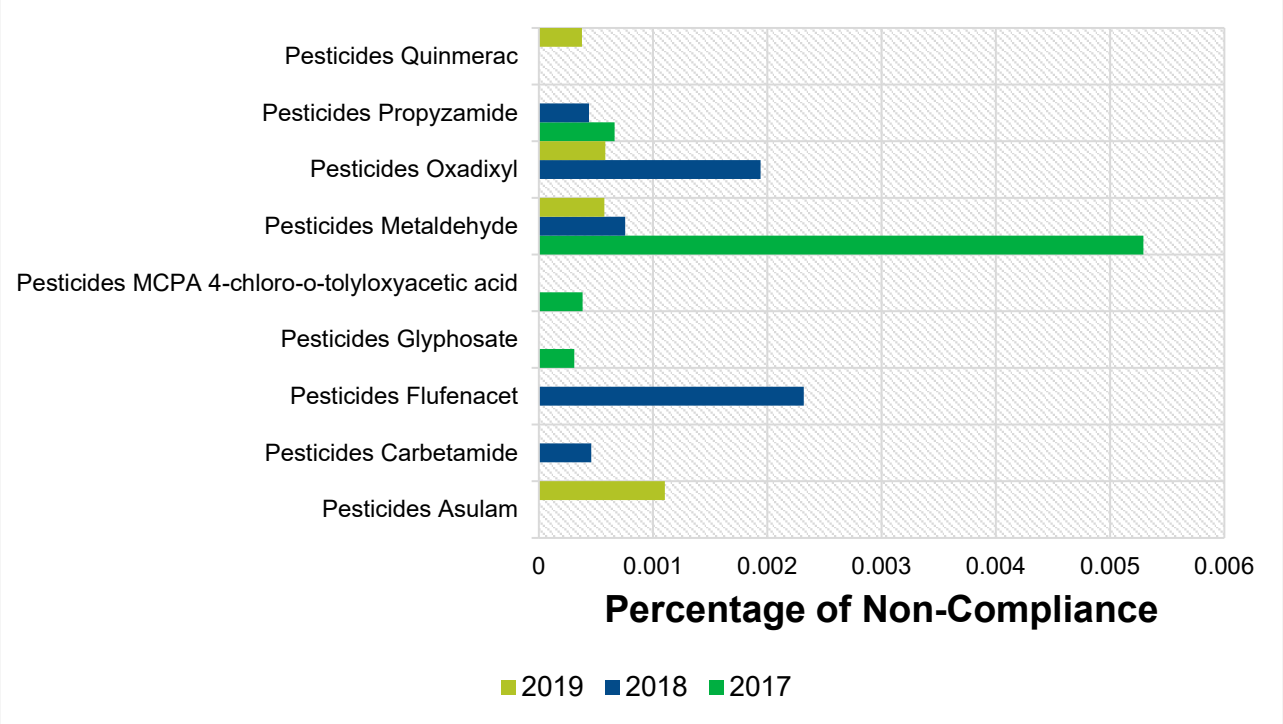
Pesticides

A limit of 0.1 micrograms per litre applies to individual pesticides in drinking water. This very low limit means that consumers are normally protected even where marginal failures occur.

Individual pesticide failures occurred for several herbicides including glyphosate, MCPA, propyzamide, carbetamide, oxadixyl; and slug pellets which contain metaldehyde. The failures are shown in Figure 2. Catchment management is the most effective way of avoiding pesticides from entering water courses, and this can be seen to have been effective for metaldehyde over the three-year period 2017 to 2019. Farmers and landowners working in partnership with water companies are encouraged to apply pesticides safely to minimise the mobility of pesticides and the likelihood of them reaching the source water. Many pesticides are effectively removed by treatment with activated carbon or ozone.

A ban on metaldehyde is being introduced in England. From 31 March 2021 no further supply will be permitted, although distributors can still sell stocks and use can continue until 31 March 2022.

Figure 2. Details of individual pesticide exceedances in England



Further information on the assessment of water company performance can be found in the Chief Inspector's Annual Report.

Sampling results for private water supplies

Private supplies in England, in common with many areas of the world, are variable in quality, and although many are excellent, compliance with the regulatory standards is worse than public supplies. Local authorities are the regulators of private water supplies.

Whilst this report concentrates on the 11 largest private supplies, further information on all private water supplies is available in the Chief Inspector's Annual Report on private supplies.

Summary data for the largest private supplies serving more than 5,000 consumers, or 1,000 cubic metres a day is shown in Table 5. All of the large private supplies have had a risk assessment carried out by the local authority, to determine the quality of the supply and to identify remedial actions required for improvement.

Table 8. Percentage compliance for large private supplies

Parameter group	2017	2018	2019
Microbiology	99.58%	99.72%	98.86%
Chemicals	98.20%	97.57%	98.79%
Indicator parameters	96.28%	95.21%	96.83%

The numbers of samples and failures for each parameter for the large private supplies are shown in Tables 9 to 12.

Table 9. Compliance data 2017 – 2019 for microbiological parameters in large private supplies.

Parameter	2017 Samples Taken	2017 Fails	2018 Samples Taken	2018 Fails	2019 Samples Taken	2019 Fails	Percentage compliance 2017-2019
E coli (faecal coliforms)	538	3	461	2	465	4	99.39%
Enterococci	177	0	253	0	239	4	99.40%

Table 10. Compliance data 2017 – 2019 for chemical parameters in large private supplies.

Parameter	2017 Samples Taken	2017 Fails	2018 Samples Taken	2018 Fails	2019 Samples Taken	2019 Fails	Percentage compliance 2017-2019
1 2-Dichloroethane	10	0	4	0	61	0	100.00%
Aluminium	153	0	102	0	158	0	100.00%
Antimony	2	0	6	0	72	0	100.00%
Arsenic	22	1	9	0	75	0	99.06%
Benzene	9	0	4	0	61	0	100.00%
Benzo[a]Pyrene	0	0	4	0	61	0	100.00%
Boron	4	0	8	0	75	0	100.00%
Bromate	3	0	10	0	60	0	100.00%
Cadmium	2	0	6	0	72	0	100.00%
Chromium	2	0	6	0	70	1	98.72%
Colour	535	0	421	0	435	3	99.78%
Copper	6	0	8	0	76	1	98.89%
Cyanide	1	0	4	0	64	0	100.00%
Fluoride	18	5	12	0	67	0	94.85%
Iron	461	16	456	27	448	8	96.26%

Parameter	2017 Samples Taken	2017 Fails	2018 Samples Taken	2018 Fails	2019 Samples Taken	2019 Fails	Percentage compliance 2017-2019
Lead	20	0	10	2	89	5	94.12%
Manganese	455	8	423	10	447	17	97.36%
Mercury	1	0	4	0	65	0	100.00%
Nickel	4	0	6	0	73	1	98.80%
Nitrate	558	11	499	10	429	2	98.45%
Nitrite - Consumer's Taps	244	0	202	0	197	0	100.00%
Nitrite/Nitrate formula	224	0	225	19	206	0	97.10%
Odour	299	8	283	11	305	5	97.29%
Polycyclic Aromatic Hydrocarbons	0	0	2	0	0	0	100.00%
Selenium	3	0	6	0	73	0	100.00%
Sodium	22	2	9	0	76	3	95.33%
Taste	254	6	247	1	268	9	97.92%
Tetra-chloromethane	10	0	6	0	59	0	100.00%
Trichloroethene & Tetrachloroethene -	19	7	6	0	62	0	91.95%
Trihalomethanes	2	0	4	0	59	0	100.00%
Turbidity	608	7	541	6	544	3	99.05%

Table 11. Compliance data 2017 – 2019 for indicator parameters in large private supplies.

Parameter	2017 Samples Taken	2017 Fails	2018 Samples Taken	2018 Fails	2019 Samples Taken	2019 Fails	Percentage compliance 2017-2019
Ammonium	481	0	454	0	375	0	100.00%
Chloride	21	0	2	0	62	0	100.00%
Clostridium Perfringens	117	0	87	0	79	1	99.65%
Coliform Bacteria	529	21	461	16	472	33	95.21%
Colony Counts After 3 Days At 22ºC	596	0	488	0	508	0	100.00%
Conductivity	679	0	613	0	570	0	100.00%
Hydrogen ion (pH)	679	117	606	114	548	48	84.78%
Sulphate	5	0	2	0	70	3	96.10%
Total Organic Carbon	6	0	2	0	0	0	100.00%
Tritium	3	0	0	0	1	0	100.00%

Table 12. Compliance data 2017 – 2019 for pesticides in large private supplies.

Parameter	2017 Samples Taken	2017 Fails	2018 Samples Taken	2018 Fails	2019 Samples Taken	2019 Fails	Percentage compliance 2017-2019
Pesticides (Individual)	88	0	182	0	71	0	100.00%

Parameter	2017 Samples Taken	2017 Fails	2018 Samples Taken	2018 Fails	2019 Samples Taken	2019 Fails	Percentage compliance 2017-2019
Pesticides (Special)	3	0	8	0	231	0	100.00%
Pesticides (Total by Calculation)	0	0	4	0	55	0	100.00%

The most common failures for these largest supplies are trichloroethene & tetrachloroethene, (91.95%), lead (94.12%), fluoride (94.85%), sodium (95.53%) and iron (96.26%).

Trichloroethene & tetrachloroethene are solvent contaminants associated with dry-cleaning metal degreasing industries.

Fluoride is a naturally occurring mineral found in water. The amount of naturally occurring fluoride in water varies across England due to geological differences. Sodium and iron are similarly naturally occurring. Sodium is not a health risk at concentrations found in drinking water but may give rise to an unacceptable taste. Similarly, for iron, there is no health based guideline, although high concentrations may result in a colour or staining of laundry.

This profile is not indicative of all private supplies, and in smaller supplies faecal contamination is one of the most common problems. In 2019, 5.4% of samples from all private supplies contained E.coli and 6.6% contained Enterococci. Failures of these two standards mean that the water supply is contaminated with faecal matter and there is a risk that harmful pathogens will also be present. Smaller supplies are discussed in more detail in the Chief Inspector's Annual Report on private supplies.

The Inspectorate provides an advisory service to local authorities, private supply owners or the industry associated with private supplies who contact an Inspector through their website or public phone enquiry line. The Inspectorate also provides a private supply risk assessment tool which is widely used by local authorities and their contractors.

During 2019, the Inspectorate completed one research project, focussing on chemical disinfection of private water supplies. They have another project ongoing looking at whether it is possible to produce risk maps for parameters failing the prescribed standard.

The Inspectorate is also progressing a sampler certification scheme. The sampling procedures manual is available on the Inspectorate website and the manual is to be used as the reference document for ISO 17024 accreditation of local authority samplers.

Maintaining standards into the future

This report shows what can be achieved through effective water safety planning, compliance assessment and targeted regulation, to deliver high quality drinking water in England. As enforcers of the Regulations for public supplies, the Inspectorate will continue to work with water companies and regulators to ensure that catchments, water treatment works, and distribution networks are suitable to meet the challenges of the future, from climate change, contamination, and population growth. The Inspectorate will also continue to provide scientific and technical advice to local authorities, private supply owners and the associated industry. Through this work they will pass on a sustainable and high-quality water supply to future generations.